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ADMIRAL SIR W. HOUSTON STEWART, G.C.B., Member of Council, in the Chair.

ENTRY AND TRAINING OF NAVAL OFFICERS.

By Rear-Admiral N. BOWDEN-SMITH.

IN February last Admiral Mayne read a paper on recent Naval Manœuvres, in which he alluded in disparaging terms to the system of training involving early entry as now established on board the "Britannia," and expressed an opinion that the "Britannia" should be abolished.

Shortly afterwards some of the naval Members of Parliament expressed a similar opinion. It is therefore the object of the present paper to elicit from those who hold these views what system they propose to set up in place of the "Britannia," should the present training of naval Cadets be abolished; for surely they cannot wish to see young gentlemen come straight on board a ship from school, at the age of 16 or 17, and take their place as Officers without any preliminary training.

Such boys, although they might have passed a very good examination on shore, would be ignorant of everything pertaining to a ship, know nothing of signals, or the management of boats, and would, in fact, for the first year, be entirely useless, knowing much less about their duty than the ordinary seamen and boys under them.

I cannot suppose, therefore, that it can be the wish of any naval Officer to advocate such a system in lieu of the one now carried out at Dartmouth.

In this paper, I wish it to be distinctly understood that whenever the "Britannia" is alluded to it is not intended to apply to the

"Britannia" as a ship *versus* a college, but to the "Britannia" system, which could be carried out just as well in a building on shore, near the water, as it can be on board a hulk. A ship has some advantages over a house; indeed, the advantages and disadvantages between a ship and a house are very evenly balanced; but it is not intended to go into that question at present. I may add, however, that, as regards locality, I believe Dartmouth is the best place on our coast for a junior Naval Establishment.

In comparing our system with that carried out by some other nations, I have selected France, because she is the greatest naval Power after ourselves, and is our nearest neighbour.

I have mentioned the United States because, although they have not at present a very powerful Navy, they bid fair to have one, and are an English-speaking race like ourselves. Their training establishment also, at Annapolis, is the most complete I have seen, and is on a very large scale. Last, but not least, I have brought in Holland, because, though one of the smaller Powers, she has naval traditions second to no other country; moreover, she has, like ourselves, very important Colonies.

The system of early entry as carried out in England is, I understand, approved of by many naval Officers for the following reasons:—

First. The life of a sailor being an unnatural one, it is considered that by early association with the sea it becomes a sort of second nature, and that a man feels the restraint and discipline of a vessel of war less irksome if accustomed to it from boyhood than he would if entering the Service later in life.

Secondly. It is considered by many Officers that no one should have charge of a watch until he has had four years' experience in a sea-going ship. If a young gentleman therefore joins the "Britannia" at 14, and remains two years under training, he goes to sea at 16, and becomes Sub-Lieutenant about 20, after which age I do not think it advisable to keep them in the rank of Midshipmen; whereas, in some foreign Navies they are still under training until 21, or even later.

In England the candidate for a naval Cadetship may present himself for examination (after nomination) between the age of 13 and 14½ years.

This is, I admit, full young, and possibly renders the medical examination less effective than it would be if conducted at a later age. Hitherto the Cadets in the "Britannia" have suffered considerably from measles, mumps, scarlatina, and other maladies common to young people, involving the loss of much valuable time; but, now that the age has been increased, we may hope that many of the boys will have got over their infantile complaints.

It seems also a pity to take a boy away from his school and general education before he is 14 years of age, and the nominations should be

so arranged that the Cadet shall not join the "Britannia" till he is 14, or nearly so.

Some people are under the impression that in foreign Navies boys are prevented by law from becoming naval Cadets before they are 16, but this is not the case.

In France the age for entry is between 14 and 18, but, as the competition is open and a boy may go up for examination every year until he is past the age limit, a lad must be very clever to get in before he is 15 or 16.

When visiting the "Borda," at Brest, some years ago, the Captain informed me he preferred having the Cadets at the earlier age.

The examinations for entry only take place once a year, instead of half-yearly as with us.

French naval Officers are allowed to count their time for pension and retirement from the age of 16, thus including part of the time they are under training. French Cadets remain two years attached to the "Borda," then embark as "aspirants" of the 2nd class on board a sea-going training ship, where they pass nine months, and then have to spend two years on board a vessel of war as "aspirants" of the 1st class, when they become "Enseignes de Vaisseaux." Thus some of them will be 21 before they become "Enseignes."

In the United States Navy a candidate for the Naval Academy must be not less than 15, nor more than 20, years of age. He must "be physically sound, well formed, and of robust constitution." If rejected at the examination, "he shall not have the privilege of another examination for admission to the same class, unless recommended by the Board of Examiners."

The examination for admission is not competitive, and is held only to ascertain proficiency, for which there is a fixed minimum for every branch, which is rigidly exacted. A competitive examination is frequently held for the nomination, and this custom is becoming more general. It is entirely optional with the Member of Congress, whose right to the nomination is qualified only by the legal requirement that the nominee must be an actual resident of his district.

The training consists of four years at the Academy, followed by two years at sea. All Cadets are kept an equal time, except in exceptional cases, such as severe illness, when a Cadet may be given an additional year at the Academy. Promotion to a higher class is not allowed, even in case of exceptional cleverness, as they think there is sufficient in the course to occupy the time of the cleverest.

There are some few elective branches of study, but these are in addition to the regular course which all are required to pursue.

After the two years at sea the Cadets return to Annapolis for graduation, when the greater part of those who are retained in the Service are appointed Ensigns, a few being gazetted Assistant-Engineers, and Second Lieutenants of the Marine Corps. The majority resign, or are honourably discharged; thus taking the year from 1st September, 1888, to 23rd November, 1889, the following list will show the disposal of the Cadets:—

Appointed Ensigns	25
„ Assistant-Engineers	2
„ Second Lieutenants of Marines ..	1
Honourably discharged..	16
Resigned..	52
Dropped	1
Dismissed	2
Died	1
Total	100

As the Americans propose to increase their Navy, it is supposed that in future a larger number of Cadets will be graduated Ensigns, &c.

In Holland the age for entry is between 14 and 17, and, as in France, competition being open, it is difficult for a boy to get in earlier than 15; however, when I was at Helder, a short time ago, I saw two boys amongst the Cadets much smaller than the others, and was told that they were not 15, though some of the lads were over 20. This is accounted for by the fact that they allow Cadets to remain at the college until they can pass out up to a certain limit of age. The course of instruction is four years, but a good deal of the last two years is spent afloat in a small sailing corvette. The Dutch have a handsome college at Helder, with 150 Cadets under training, that number including a few for the Marines.

We now come to the question of open competition *versus* nomination for entry, and, after relating what the system is at present in England and the other three countries, I will state my own opinion.

In England appointments are made to naval Cadetships by limited competition, with some exceptions, as follows:—

Four are given annually to sons of gentlemen in the Colonies, on the recommendation of the Secretary of State for the Colonies. Service Cadetships, the total number of which is not to exceed five in any one year, are selected by the Board of Admiralty from sons of Officers of the Army, Navy, or Marines who have been killed in action, lost at sea, killed on duty, or have died of wounds, &c. Except in special circumstances, not more than one-third of the number of candidates actually presenting themselves before the Civil Service Commissioners are entered.

All nominations of candidates for naval Cadetships are made by the First Lord, with the exception of a limited number which are at the disposal of individual members of the Board of Admiralty. Admirals and 1st Class Commodores are allowed two nominations on hoisting their flag, and Captains are given one on commissioning a ship, but this right, as regards Captains, can only be exercised once.

In France and Holland, as has already been stated, naval Cadetships are thrown open to public competition; but in the United States a nomination is necessary. The President has ten, and the others are in the gift of the Members of Congress.

Having carefully considered this matter, I am strongly in favour of open competition, except that I should like to see a number of Cadetships reserved for the sons of deceased and meritorious Officers; but even these candidates should be required to pass a severe test, and no boy of less than ordinary ability should be allowed to enter, no matter how distinguished his father may have been. The late Sir Alfred Ryder proposed a plan for dividing the nominations between some of the best of our public schools, but who is to choose the schools, and what would those schools say which were left out? Besides, if a man wished to educate his son in Germany, or at home, with a tutor, why should he not do so? Again, with regard to the schools, what reason have we to suppose that if nominations were given to them the best and cleverest boys would endeavour to compete, as has been assumed by the adherents of this scheme? The prizes which the Navy offers are not so great as those offered by the Bar and some other professions, and I see no reason, therefore, why all the best boys should compete for naval Cadetships.

On the other hand, I see no reason why a boy who has a strong desire to go to sea, who is sufficiently educated, and whose friends are able to pay the annual charge for him, should not be allowed to compete at the half-yearly examinations, provided, of course, he is of good character and can pass the medical examination. It may be argued that all *desirable* boys who wish to go to sea do at present get nominations; but some men are too proud to ask for favours, and thus it happens that a really desirable boy is lost to us, and drifts into the merchant service.

It used to be said that it would be cruel to make the competition open amongst such very young boys, but since that objection was made, the age for entry has been increased by one year, and the same efforts would be made by a keen boy desirous of entering the Navy when competing against two other candidates as against ten. Cadetships given by nomination tend, I fear, in some instances, to make fathers urge their sons to join the Navy whether they really care for it or not. It is at present the cheapest education going, and if a boy does leave at 18 or 19, he is just as fit for many occupations as he would have been had he been educated at a public school at double the expense.

During the time I commanded the "Britannia," two brothers passed through the ship, and, knowing that a third had passed out a short time before, I wondered what made all these boys so fond of the sea; then I discovered the father was an Irish landlord, and, as I felt sure he could get as many nominations as he chose, I ceased to wonder.

I not only think it would be right to throw Cadetships open, but believe we should get as good Officers as we do at present, if not better.

I advocate, therefore, open competition for the Navy, the First Lord being allowed to reserve about 10 per cent. of the vacancies for special cases. For these, nominations would be necessary, subject to limited competition. The Colonial Cadetships might be abolished, as,

the Service being open, the sons of Colonial gentlemen, if British subjects, would have the same opportunity of competing as any one else.

One argument brought against the present "Britannia" system is that it is expensive, and that a considerable portion of the cost of the maintenance and education of the Cadets is borne by the State. This is, doubtless, the case, but it must not be assumed that in this matter we are more liberal than other nations; indeed, I propose to show that in some cases the contributions from the State towards the naval training establishment are greater than ours. In France, the charge for each Cadet is 700 francs a year, and the outfit for the two years is about 1,000 francs, so that the total charge for the two years is only about 96*l.* in our money; and in some cases, where the parents or guardians are unable to pay, the whole or a portion of this sum is remitted, and paid by the State.

The Cadets in the United States are granted a salary of 500 dollars a year immediately on joining the Naval Academy at Annapolis, which is supposed to cover the cost of their maintenance and instruction.[1] Many more Cadets are admitted than are required to fill vacancies, consequently, only a small proportion finally enter the Navy. Thus, naval Cadets in America are educated at the cost of the State, whether they remain in the Service or not.[2]

In Holland the Cadets have to contribute 400 gulden (about 35*l.*) a year, and, as the course lasts four years, it makes a total sum of about 140*l.* to be paid by the parents or guardians of each Cadet. The naval Captain in charge of the Establishment told me that, in addition, he thought each Cadet cost the State 100*l.* a year. Here also the sons of deceased Officers, or other exceptional cases, are admitted free.

On board the "Britannia" the charge at present for each Cadet is 75*l.* a year for ordinary cases, and 40*l.* a year for Service Cadets, that is, sons of meritorious Officers and special cases. In addition to this, the parents or guardians have to pay for the outfit, which, during the two years, should not exceed 50*l.* or 60*l.* No Cadets are admitted free, nor at reduced prices below those stated.

With regard to the charge of the excessive cost of the "Britannia," the school could, of course, be made self-supporting by increasing the charge for the ordinary Cadet to 100*l.* a year; but, remembering that an outfit has to be provided by the parent, this limit should not be exceeded. At that price it would still be the cheapest education of the kind in England, for I am informed that a boy cannot be kept at any of the ordinary public schools under 150*l.* a year, and at Eton the

[1] They have to supply their outfit and to lodge 20 dollars with the pay Officer, for the purchase of text-books and other authorized articles in addition to those enumerated in the outfit.

[2] Each Cadet, however, on entry is required to sign articles, by which he binds himself to serve in the United States Navy eight years (including his time of probation at the Naval Academy) unless sooner discharged.

expense is greater. Some of the boys before joining the "Britannia" are sent to crammers, where they pay at the rate of 200 guineas per annum. If the ordinary Cadets paid 100*l.* a year, instead of 75*l.* as at present, the gain to the country would be a little over 5,000*l.* a year.

Whilst seeing no reason why the Cadets should not contribute more to their education and maintenance, supposing the supply to be plentiful, and whilst strongly objecting to see the Navy made a receptacle for the sons of impecunious gentlemen who have sufficient interest to get nominations, I should be very sorry to see the sons of gentlemen of small means kept out of it by unduly increasing the charges. Amidst all the extravagance and luxury of the present time, the Naval Service has, to a great extent, kept to its simple habits, and Officers, after attaining the rank of Lieutenant, are able to live on their pay, and not only to live, but are able to go into society and see something of the many places of interest they visit.

Naval messing is cheap, and a source of astonishment to any householder who looks into it, and I should regret seeing anything done to destroy our simplicity of life and habits.

A very important subject in connection with the question we are considering is the examination for the the entry of Cadets. This should be made as general as possible, and in England it is so, for all candidates are tested by examination in the following subjects:—

	Marks.
1. Arithmetic: including proportion, vulgar and decimal fractions	250
2. Algebra: including fractions, simple equations and problems and quadratic equations of one unknown quantity	200
3. Geometry: Euclid, Book I, with exercises and questions.	200
4. English: handwriting, dictation, reading with intelligence, and composition	150
5. French: translating French into English and English into French; grammatical questions, speaking, and dictation	250
6. Scripture	100

Note.—Candidates will be required to obtain half marks in arithmetic, and 40 per cent. in each of the other subjects.

Candidates will be further examined in—

7. Mathematics: harder questions in arithmetic, algebra, and geometry	300
8. Latin: translation, grammar and prose composition	300
9. Geography: subjects treated of in Grove's Primer, and elementary knowledge of principal places in British Isles and dependencies	150
10. English history: short selected period	150
11. Drawing: free-hand and simple rectangular model	100

A candidate who passes the test examination, but does not succeed in the competition, is entitled to compete at the next examination,

provided he is within the limits of age at that time, but no candidate is allowed to compete more than twice.

Any boy who obtains admission into the Service by competition should have no difficulty in finally passing out, and the loss in the "Britannia" is but small: thus, in six years, from June, 1881, to November, 1887, the percentage of loss through failing to pass out, or from being withdrawn, was 6·7 per annum.

With regard to France and Holland, I have been unable to find out the exact percentage of loss, but I was informed that it was very small.

In France the subjects in which the candidates are examined are—

French.
Latin.
English.
History.
Geography.
Drawing.
Arithmetic.
Algebra.
Trigonometry.
Geometry.
Physics.
Chemistry.

Note.—A knowledge of the German language will be taken into consideration.

In the United States the examination for entry does not appear to be so general as in France and England, the subjects being reading and writing, spelling, arithmetic, algebra, grammar, geography, history. The requirements, however, under these heads, with the exception of algebra, which is only elementary, appear to be very thorough; thus, under reading and writing it states that the candidate "must be able to write legibly, neatly, and rapidly," and after defining the requirements under arithmetic, the article concludes by enacting that the "candidates are required to possess such a thorough understanding of all the fundamental operations of arithmetic as will enable them to apply the various principles to the solution of any complex problem which can be solved by the methods of arithmetic; in other words, they must possess such a complete knowledge of arithmetic as will enable them to proceed at once to the higher branches of mathematics without futher study of arithmetic."

The examination in history appears to be confined to the history of the United States, but it embraces questions on the different forms of government, and also requires an account of the formation and adoption of their Constitution.

With reference to the subjects taught whilst under training, some difference exists between the different countries. When the Cadet has joined the "Britannia," he gives up Latin altogether, and arith-

metic after the first term, but he has to commence navigation and nautical astronomy, and he is also instructed during the latter part of his time in trigonometry, steam, and physics. All have to learn mechanical drawing, but free-hand drawing and colouring are only taught those who show a taste for it. French is the only foreign language taught, and the result after the two years on board is not very satisfactory.

The Cadets have at once to commence a course of seamanship instruction, which embraces knots, splices, and hitches, tackles, the compass, log and lead, the names and uses of all masts and sails, a knowledge of anchors and cables, the management of boats under oars and sails, and signalling, including semaphore and Colomb's flashing lights. They go outside occasionally in the tender and work the sails and the engine, but never for more than half a day at a time. They are not instructed in gunnery or rifle drill, but go through a course of setting up and position drill. Gymnastics taught in the gymnasium are compulsory, each Cadet having about one hour a week till he passes out.

In saying that the results of the French instruction on board the "Britannia" are not satisfactory, I do not mean to imply any want of zeal or energy on the part of the masters.

The greatest obstacle to success is the nature of the pupil, the average British boy absolutely declining to learn French. He thinks his own language good enough, and does not care to learn any other. When he gets older, this antipathy wears off; he finds that in some places he visits he does not get on so well in society as others who speak the language, and he envies a brother Officer's amusement over a French novel.

Many naval Officers therefore later in their career have taught themselves one or more languages, and the Admiralty have, by recent legislation, encouraged the study of languages; but we must admit that, in this respect, we are behind the Officers of other Navies.

It has been suggested by a Flag Officer that no one should be given an independent command until he could speak at least one foreign language, and this proposition seems worth consideration.

When visiting the "Borda," at Brest, I asked the Captain if he thought the French Cadets could all speak English after their two years' instruction on board, and he said, "he feared not," but I have noticed that the German, Dutch, and Swedish naval Officers are very good linguists. In the Dutch Naval Academy at Helder, the Cadets have to learn four languages, French, German, English, and Malay, and after their four years course they are fairly proficient in most of them.

The present courteous Minister of Marine at the Hague (himself a naval Officer), and several other Officers with whom I came in contact, spoke English fluently.

Whilst on the subject of languages, I would observe that, although one language is sufficient to be regularly taught on board the

"Britannia," I see no reason why other languages should not be encouraged by allowing marks at the half-yearly and final examinations for German, Spanish, Italian, or Russian. Occasionally a boy joins the "Britannia" knowing something of one of the languages I have mentioned, but, as they confer no advantage, he speedily forgets all he knew, whereas, if marks were allowed, he might possibly in his spare time be induced to keep up what he has already learnt.[1]

Some difference of opinion exists on the question of drawing. In recent years, at Dartmouth, though all the Cadets are instructed in mechanical drawing and making charts, only those who are artistically inclined are taught sketching and colouring.

In France and Holland all the Cadets are compelled to learn drawing of every kind, whether they show a taste for it or not; but in the United States mechanical drawing alone is taught, on the plea that time does not permit of anything further, and yet their course of studies extends over a period of four years. In this matter I think the English system is decidedly the best, for, although drawing and painting are graceful and useful accomplishments for naval Officers, it seems little use to teach them to boys who have absolutely no taste for them, and who would probably never touch a pencil or brush after leaving the "Britannia."

Curiously enough, although at the Naval Academy at Annapolis they profess to have no time for drawing, dancing and fencing are made part of the instruction. I would also here observe that at this magnificent establishment, of which the Americans are justly proud, the Cadets, who enter older than ours, and remain two years longer under training, are naturally taken much further in mathematics and science than the "Britannia" Cadets.

It was on a Saturday when I visited the American Naval School, situated in park-like grounds on Chesapeake Bay, and therefore I did not see the establishment at work, but the young men were at the time drawn up under arms for inspection by the Secretary of the Navy (Mr. Tracy), and marched past in a most creditable manner. I had also the good fortune to see them turn out afterwards in flannels, to play a game of football, when they had all the appearance of young men at an English school.

Although baseball is the national game in America, football seems to be getting popular, and at Washington scarcely a Saturday afternoon passes without a match being played between two rival teams.

Any Englishman visiting the United States for the first time must be pleased to see his own manly game played in good form, and be proud to acknowledge his near relationship with this English-speaking nation of 60 million people.

Although the Cadets go to sea in a training ship for three months in each year during three out of the four they spend at Annapolis, I consider four years' training to be excessive, and have no wish to see our course prolonged to that time, believing that the proper place

[1] In the United States Naval Academy, although most attention is paid to French, Spanish and German are given as an advanced course.

for training sailors practically is the sea itself, and not a shore establishment, however good it may be. It will be observed that whilst France and England still hold to a ship for their training school, the Americans and Dutch have a college on shore.

The Dutch Naval Academy at Helder has only been completed three or four years, and is a fine building with good library, recreation room, and gymnasium, besides the usual studies, dormitories, and mess-room.

It has been said that foreign naval Officers are better educated than ours, and that therefore a change should take place in our system.

Now it goes without saying, that if there are two boys of equal intelligence, the one who leaves school at fourteen, and then passes only two years at a Naval Training Establishment, cannot be so well educated, in one sense of the word, as the other boy who does not leave school till he is sixteen, and then spends from three to four years at a Naval Academy. But there are two sorts of education: there is the one which is learnt from books and professors, and there is the other which is acquired from experience, and I am no advocate for giving up the four years' practical training which is now given to our Midshipmen on board sea-going vessels. You may give a boy such a dose of instruction in his youth as to deter him from studying the same subjects again in after life, whereas many of our naval Officers do continue to educate themselves long after they are made Lieutenants; besides, I have yet to learn that our naval Officers are inferior to any others in practical qualifications. I cannot admit that foreign men-of-war are in better order or better handled or navigated than the ships of Her Majesty's Navy; and although foreign Officers are doubtless better linguists, and may have made greater progress in mathematics and science, we should remember that the first duty of a naval Officer is to handle and navigate his ship, and the second is to understand the management of men. This latter qualification is, perhaps, more important with us than any other nation, because, having no conscription in this country, we have to look to volunteers to man our Fleets and Armies. We have a large Fleet scattered all over the world, so that we are able to distribute our Midshipmen in small numbers, instead of crowding them all in one sea-going training ship, a system which I have always considered objectionable, and which has been tried and has failed in England. The Midshipmen, if wisely distributed, learn their duties by actual experience. One is placed with the Navigating Officer for three months; one with the Gunnery Officer; another is placed in the signals; and, if there are sufficient, one might be attached to the Chief Engineer, not only at sea, when the ship is steaming, but in harbour, when the engines are opened up, and other necessary work has to be done. In making this suggestion it is to be understood that I am not in favour of abolishing the Engineers as a class, as has been suggested by some, but I think as sails for vessels of war are things of the past, and we are in future to look

entirely to steam as our motive power, naval Officers should have a good practical knowledge of the steam engine. The accountant Officers, as a class, might possibly be abolished with advantage, but I should not care to command a ship whose engines were in charge of an amateur Engineer, nor should I like to be subjected to the possibility of having my arm or leg amputated by an amateur Surgeon.

The Cadets in the "Britannia" have longer vacations and shorter working hours than the Cadets in similar establishments abroad, but this is only in accordance with our general English school system, which is less severe than that of the Continent, and it must be borne in mind that manly games and other athletic exercises are not encouraged abroad as they are with us.

On the other hand, as already stated, they are not taught any gun or rifle drill, or sword exercise, which is carried out in all foreign academies. As there is so much to be learnt, I think it quite right that this instruction should be left till they embark in a sea-going ship, where a young Officer lives amongst the guns, and where he can be drilled with great facility, and be exercised also with others in small arm drill.

Although Officers educating for the British Navy spend a shorter time on board the training ship on first entering than those of most other nations, we have our Naval College, at Greenwich, and Gunnery and Torpedo Schools, at Portsmouth, where Sub-Lieutenants go through a course of instruction before their final examination. This part of our system is, as far as I am aware, unique, and is not carried out by any other nation, and although many Officers complain of the time Sub-Lieutenants are kept at the College away from their active duties afloat, it appears to me a better system than the one of keeping them from three to four years under training on first entry at a shore establishment.

The weak point in our system is the fact that it has necessitated our having Naval Instructors on board many sea-going ships, but this might in future be discontinued.

Cadets will now go to sea a year older than formerly, and as it is absolutely necessary to reduce the number of non-combatants on board our ships, Naval Instructors when not in Holy Orders might be abolished by making no more entries, and thus allowing the rank to become extinct.

As it is highly necessary, however, that the Midshipmen should be encouraged to educate themselves, a Lieutenant might be directed, where necessary, to assist them in their studies. The Officer selected would receive extra pay, and, if a watch keeper, would probably be excused his watch in harbour. Any Lieutenant who had gone through a course at Greenwich ought to be able to instruct the junior Officers. The knowledge that they have to pass a stiff examination at Greenwich should be a sufficient inducement to young Officers to continue their studies, and time and opportunity should be afforded them to do so. There is a well known case of an Officer who passed a considerable portion of his Midshipman's time in a small vessel without a Naval Instructor, and yet worked so well by

himself that, at his final examination, he obtained his Lieutenant's commission. The "Britannia" is an excellent school, and, though possibly not perfect, is constantly improving. The Captain is wisely changed every three years, and as he is usually appointed straight from a sea-going ship, and has probably had some of the recently embarked Midshipmen under his orders, he has been in a position to notice any weak points in their practical training, and is able to make alterations or suggestions. The Chief Instructor is properly a permanent Officer, and anyone knowing the gentleman who occupies the post at present will testify to the interest he takes in the Naval Service, and to his readiness to adopt any improvements. In course of time, as masts and sails become entirely abolished, it may be necessary to make some further change in our system, but as the recent alteration in age has only lately come into force, I would strongly advocate leaving matters as they are for the present, and would venture to protest against the cry for the abolition of our present training establishment without proposing anything else to take its place.

From the foregoing it will be gathered that I am not in favour of making any radical change, my only suggestions being as follows:—

First.—That Cadetships for the Navy should be open to competition with the reservations proposed.

Second.—That marks for other modern languages besides French should be given on entry, and that Cadets whilst in the "Britannia," though only instructed in French, should be allowed marks for German, Spanish, Italian, or Russian, as extra subjects.

Third.—That any candidate who passes the test should be allowed a second trial if under fifteen years of age, the object being to deter boys from going up for their first examination before they are fourteen.

Fourth.—Whilst unable to propose any practical plan for awarding marks to those candidates for Cadetships who excel in athletic or gymnastic exercises, it would tend to encourage them if whilst on board the "Britannia" such marks were granted.

Prizes are already given to the best swimmers and best gymnasts in each term, and if these were accompanied by a few marks it would tend still farther to encourage these excellent exercises.

Rear-Admiral R. C. Mayne, C.B., M.P.: Mr. Chairman, and gentlemen, as this paper is manifestly intended as a reply to the views on naval education in a paper which I read in this Institution last summer, it is, perhaps, right that I should open the discussion. I regret that at the outset I must take exception to the whole basis of the lecturer's argument. In the first place he says that I "alluded in disparaging terms to the system of training involving the early entry as now established on board the 'Britannia.'" I can only say I had not the slightest intention of alluding in any disparaging terms to the actual education carried on on board the "Britannia," but to the system which embodies a "Britannia" at all. Then he goes on to say that there is surely nobody who wishes to send Officers to sea without attending some training vessel or college. "I cannot suppose, therefore, it is the wish of any naval Officer to advocate such a system in lieu of that now carried out at Dartmouth." This reminds me of the well-known story of the two

Frenchmen who were discussing how to cook a fowl, when the fowl raised the objection that he did not wish to be cooked at all, "Mais," said one of the gentlemen, "vous évitez la question, Monsieur le coq." I am one of those who wish to see Officers or young gentlemen go straight to sea from public schools, or from other educational establishments, and that is the sum of my objection to the present system. When I look to see what I really had said, I found that I said our system of training was not the best in my opinion, "that too much time was spent at college and in training ships, that we did not require our people to design or build ships, guns, or torpedoes, but to manipulate them, and to develop their utmost power, and to have such physical training as shall, under the misnomer of nerve, qualify them to handle the biggest ships under the most trying circumstances, never forgetting that a single wrong order at a critical moment may cause the loss of a ship, and perhaps of a fleet." The real question is, What do we mean by education? One set of people consider that the end and aim of all education is to bring up a boy to a certain standard, to pass a certain examination at a fixed date. That is not my view of education. My view is that which will best fit the man to take his position among his fellowmen as an English gentleman, or, in this case, as an English sea Officer, when he is grown up, or at the age at which he is required to take such a position. I will not enter closely into the comparison that my friend has made with foreign navies, but on the other hand I should not like to shut him up, if I may use the expression, with the promptitude with which I was shut up when I referred to the German Navy. When I pointed out the opinion of the German Officers I said what I knew to be the case, that the head of the German Naval Education stated that our system of education was so utterly unfitted for modern requirements, that they could not adopt any part of it. I was immediately met by the First Sea Lord saying that he did not wish to have the opinion of the German Officers, because he did not consider that they were capable of forming any opinion as to what our requirements were. Well, while I do not agree with that now, neither do I agree with the view that we have anything to learn, or ought to have anything material to learn as to the best way of handling our ships, and generally filling ably and well the requisite position. I apprehend the real aim of education is to fit men for holding the positions of Lieutenants, Captains, and Admirals, whenever they can attain those positions, in the ablest possible way. Admiral Bowden-Smith has spoken of the naval traditions of this country being second to those of no other country. He omits the consideration that all those naval traditions come from the time when there was no "Britannia," when we did go to sea precisely in the way I suggested. [No, no.] I should like to be corrected if I am wrong. I do not know the date of the commencement of the Naval College, but it is sufficient for my purpose that it was never compulsory to go there. There are many Officers who I know at any rate did not go through the Naval College. I mentioned that to the Chairman the other day, and he told me that he felt rather at first the want of this preliminary education in nautical matters as compared with two others who had been to the College; but I pointed out that it was sufficient for my purpose as showing this had no permanent value, that he was selected to be for ten years the Controller of the Navy. It is one of the arguments of the lecturer that the life of a sailor being an unnatural one he should enter the Service at a very early age. There, again, I disagree with him. I think that when we required to learn seamanship, that is to say, to have our hands in the tar-bucket and to be continually aloft on yards, then it was necessary to start a boy young, for the same reason, in great measure, that it is necessary to start the gymnast at a very early age indeed; but I hold that that necessity has disappeared with masts and sails. It is also, he says, considered by many Officers that no one should have charge of a watch until he has had four years' experience of a sea-going ship. [Admiral BOWDEN-SMITH: Hear, hear.] The lecturer says "Hear, hear." It may be vanity on my part, but I consider that when I came home, after three years in the "Inconstant," I was perfectly qualified to take charge of a watch; and what is more I will say this, I can remember the case of a tremendous mess, the stunsails flying all over the place, and three Lieutenants being put under arrest one after the other, and the Captain of the ship saying—I speak in memory of a very dear old friend—"Send for Mr. Burgoyne; he is the

only Officer in the ship that can carry on the duty properly." Mr. Burgoyne at that time had not been nearly four years at sea. I maintain that an Officer going at sixteen straight to sea would be far better than any system that I could imagine of training beforehand. Perhaps I hold more strongly than most people to the view that we learn very little that is worth remembering until we are grown up; that the object of boyhood's education is to teach us to learn, to teach us, in fact, application, and that it matters little what subject you set boys at, provided you teach them to learn. I would just as soon take a boy who could pass a good examination in Latin and Greek, as a boy who could pass a good examination in mathematics: I consider that we have made a great mistake in neglecting not only living languages, but those dead languages which assist us so materially in the study of living languages afterwards. To try to force all boys into mathematics is just as absurd, in my opinion, as what the lecturer spoke of in trying to force all boys to learn freehand drawing or sketching, whether they had a taste for it or not. I am glad to see that within certain limits the lecturer approves of open competition. I know that my friend Sir George Willes regrets the day when that must come.

Sir GEORGE WILLES: I have come here to contradict that.

Rear-Admiral MAYNE: But still he admits that it probably must come. I am glad, however, to find the lecturer saying so, because my friend Sir Michael Seymour, when I was lecturing, put it down as a little bit of—what shall I say?—bait for my constituents. I do not think, so far as I am aware, that my constituents have expressed any opinion on this subject, and I do not think my next election is at all likely to hinge on the question of competitive examination for Naval Cadets. But apart from that, I am glad to have the high support that I have, and I perfectly agree with the lecturer that we never meant that every vacancy should be given up. One speaks of the First Lord in these days—I suppose one ought to say that august body the Board of Admiralty—the Board of Admiralty should retain in their own hands a certain amount of nominations for deceased Officers' children, and for various other purposes; but a certain portion should be open, in my opinion, to public schools without any selection. My idea of an examination was that which I see the lecturer puts down as being, I think, that of the United State[illegible] held only to ascertain proficiency. I would not "cram" a boy to go into the [illegible]. I should like to take the raw material, only educated as any gentleman's son [illegible] age should be educated, and teach him all the rest that I want him to know after I have got him into my hands. I should then bring him back [illegible] his two or three years, as it may be, at sea, when he is of an age [illegible] can discuss the value of education with him, when he will see that he [illegible] be, and must be, well educated, if he expects to get on in his profession, and then send him to a college and force him in any way it may be thought advisable. I see my friend has barely touched upon another subject that I touched upon—what I may call the subsequent education of the naval Officer. He goes so far as to hint that he would consider whether he would, or not, give a separate command to an Officer who, to use my old Admiral's phrase, spoke "no other language than that which his mother gave him;" but I would go a good deal further than that, and I would ask why is all our education to end at nineteen or twenty? My opinion is it would be greatly to the advantage of the Service if, without drawing any hard or fast lines, without saying that Officers should not be promoted for service, without any subsequent examinations, we should have something in the nature of a Staff College, and that Officers should be obliged, in the ordinary way, to pass for Commander and to pass for Captain. I see no reason whatever against that, or, if not actually obliged to pass for these ranks, preference should be given to those who do pass examinations—not in the measure of a carpet or a wall-paper, as Lord Chelmsford once said was part of the education at that time in the "Britannia"; not even in what I believe still is part of their education, "gammoning a bowsprit," which I think may be dropped now; but in those higher qualifications which, if not absolutely essential, are, at least, highly desirable for the Captains of our ships, and still more for the Commanders-in-Chief of our stations. As to the expense, I do not wish to go into that; I think, perhaps, the State is rather overcharged, but as I should do away with this altogether until a later date, I will not enter into it. I think, if I am not mistaken,

Sir Edward Fanshawe holds somewhat similar views, which I should be very glad presently to hear him express, on the later education of young naval Officers. I remember reading a pamphlet of his on the subject with great interest. I quite agree, after all, with the summary which the lecturer makes at the end, when he says that for training sailors practically the best place is the sea itself. That is about the gist of all my argument. One word only on the "amateur" engineer. I might say, in self-defence, because of the "consternation in the engine-room" which some remarks of mine in this theatre last February appear to have produced. I had no intention of having an amateur engineer, and to take the *reductio ad absurdum* argument of my friend, that of the amateur doctor, I would ask him why should a naval Officer, that is to say, one entered in the same ranks and in the same position as our own, who studies engineering from the age of nineteen or twenty (which is the youngest age at which the ordinary engineer or the ordinary doctor commences his study), be incapable of taking proper charge of the engines, when he has completed those studies, any more than another Officer has to go through a course of study for navigation, torpedoes, or for any other special subject? My remarks of that time, which will come up again, because the question is very far from being settled, were directed rather to helping us out of a dead lift. At the present moment we have got a class of men who are not satisfied, and who will not be satisfied so long as they consider that they are essential to the Service, and who would be very foolish if they were satisfied, as long as they think they can get any more. I have nothing whatever to say against them, but I maintain that if you are to make the Engineers Commanders, Captains, and Admirals, they should be part and parcel with ourselves, of the same rank in life, the same position, and the same in every respect as Officers who select navigation, gunnery, or any other special branch of the Service.

Chief Engineer EDWARDS, R.N.: I am very glad, indeed, to find that the lecturer is not in favour of abolishing Engineers as a separate class. I think that the ordinary human mind would be incapable of becoming an efficient master of two such intricate and important professions as that of Naval Executive Officer and Naval Engineer Officer. With your permission, if I am quite in order, I should like to offer a few remarks to show why Admiral Mayne's proposition cannot be carried out. I quite admit it is a very good thing to give Midshipmen as much knowledge as possible, because I always find that I can carry out my duties much more to my own satisfaction and the satisfaction of the Service when I have an Officer as Captain to deal with who knows my profession to a certain extent, who can at all events sympathize with me and help me in the difficulties I have to encounter. Such a Captain generally has the most efficient ship, and the Captain who will get the most out of his ship is the Captain who knows her as he knows his own muscle, or his own brain. Admiral Mayne stated in the lecture that he delivered not long ago, "As regards the Engineers as a separate class, they should disappear. We have never had a more valuable and more highly respected Officer than the old Chief Engineer. There is no reason whatever to suppose that if the executive Officer devotes as much time, and no more, to learn Engineer's work as he does to learn torpedo work, he would not be perfectly competent to supervise the engine-room artificers by whom the principal part of the work is now performed, and the 'engine-room Lieutenant,' would bring to the discharge of his supervising duties the habits, constitutional and acquired, of supervision and command which are known to be the characteristics of the class which he joined on first entering the Service." That I think was stated by Admiral Mayne, in his lecture on "Lessons of the Naval Manœuvres."

Admiral MAYNE: I omitted the words "no more," because I found that they were capable of misconstruction.

Chief Engineer EDWARDS: Of course the whole question turns on the expression "no more." At all events I do not think the system proposed of training Lieutenants as Engineers, unless you can give them the same training that you give the Engineer Officers, is at all practicable, because the supervision and command in the engine-room to be effectual must be accompanied by a proper technical and practical knowledge acquired in actual workshop training, and in the use of tools that are employed in engineering work. I would here like to briefly describe the training

of naval Engineer students. Two forenoons and three evenings a week during their period of training, lasting five years, they are instructed in the theory of the steam-engine, and the sciences which bear on a proper knowledge of steam engineering, and in the remainder of their time they get practical instruction in the various workshops in the dockyard, and in ships afloat, occasionally under steam. Their training is essentially practical. I cannot quite see how you are to give the Torpedo Lieutenant practical instruction like this. You must have a man below in charge of the engine-room who not only has a fair knowledge of the theory of the thing that he supervises, but must be acquainted with the mental habits and practical training of the men. He must be a man who has been trained to know tools and materials, and must be familiar with the methods which are used in repairs in the engine-room. You cannot import the style of Drill Instructor into the engine-room. You cannot have the same habits of command which are very much in their proper place on deck, where smartness and agility at drills, &c., is a question, perhaps, of very great importance. That will not do at all in the engine-room; the whole training of an Engineer is directed to teaching the Officer to do his duty by deliberate thought and method. You cannot go to "quarters" to line up a piston, or to adjust a slide valve, or bearing. You must be trained to do things slowly and deliberately, and to consider what you are doing. For that reason alone I think it would be impossible to place a Torpedo Lieutenant in charge of the engine-room. Then you are putting your responsible Officer in the engine-room in control of a staff who know that they know more about their business than the Officer does, and what would be the result in an action if the engine-room staff had not confidence in their Officers, if they did not know that their Officer knew more about the machinery than they did? Nothing but panic and disaster. I cannot conceive that the system of having a man, who must be an amateur engineer, is going to be of benefit to the Service. You must have a man who is as well trained, in fact better trained than the men he commands, in the engine-room. The training of engine-room artificers is of a totally different character to that of seamen gunners and the sailors on deck, and the training of the naval Engineer Officer is of a very superior kind to that of the engine-room artificer. We have good practical training given to us in every detail of engineering, going through the fitting shop, the boiler-maker's shop, and so on, getting practical instruction, and we have to give practical proof of our capability of working in each shop. The engine-room artificer's training does not combine all these things. He is either a fitter, or a blacksmith, or a boiler-maker, or a coppersmith, but he does not know the whole of these trades; he is not at all capable on joining the Service of taking charge of a watch. I wonder what would have happened in the manœuvres lately if the Torpedo Lieutenants, or the Gunnery Lieutenants, had had a staff of men under their charge who were fresh from the plough tail, to work the guns or torpedoes like the men that we had. Fifty per cent. of our men had hardly ever been in a ship before, and the few breakdowns that we had in the machinery department were more due to inherent defects in the engines and boilers than to a want of knowledge on the part of the Engineer Officers, and it was only by very strict attention to their duties that they managed to get their ships through. I do not think myself that a Torpedo Lieutenant commencing at the age of nineteen, and going on for four or five years, would be as good an Engineer as an Engineer Officer who is trained under the present system by the Government. Our present system has been in force for thirty years, and I think that thirty years' experience in the Navy has completely proved that the system we have got is a much better one than that obtaining in any other Navy. Not long ago, in the "Times," there was a long list published of breakdowns in the machinery of the French Fleet. Those ships had been in commission for some time; they had their crews on board for some time, and they ought to have had some knowledge of the machinery of their ships. But the system of officering the French Navy in the Engineer's department is altogether different from ours. Their sea-going Engineers are men of inferior professional training, corresponding more to our engine-room artificers. I am not saying anything against the capabilities of our artificers, for I believe we have not a more valuable set of men in the Service, and after they have been at sea for five or six years they become very valuable. I have not said nearly as much as I should like-

to say upon this subject, I feel it is one that ought to be fully discussed here: but this I do say, I think on account of the complete change that has taken place in the last few years, since masts and sails have been abolished and machinery has been adopted to a great extent to the use of guns and torpedoes, it is absolutely necessary, if we are to maintain our supremacy on the sea, that we should face the necessity of altering our system of training naval Officers altogether. If naval Officers were efficiently trained in engineering matters, no one would welcome them more than the Engineer Officers themselves. I have heard something about Engineers wanting to be *Steam Admirals*. We do not want to be Steam Admirals; we are very proud of our own profession; we consider that it is second to none in the world; we know that fifty years of engineering has simply turned the world upside down, and has done more to advance civilization than that of the other professions linked together. I must say, as far as I know, there is no intention on the part of Engineer Officers to be anything but what they are, Engineers, and we hold that the man in charge of the engine-room, whoever he may be, whether Chief Engineer, Engineer Lieutenant, or even Steam Admiral, must be above all things a practically and professionally trained Engineer.

Admiral CLEVELAND: When Admiral Mayne spoke here last February, I was one of those who took part in the discussion, and endorsed most of the views which he addressed to the meeting on that occasion. I rather think since then we can claim another convert, and that is the worthy lecturer himself! There is very little divergence of opinion between us. I can quite understand his natural loyalty to a system which he administered for three years, and, as I always understood, administered remarkably well, but instead of dwelling upon the results in support of his argument, he has based his advocacy for the continuance of the present system principally by quotations of what is done by foreign nations. No doubt whatever good we find *anywhere* ought to be selected for our own Service, and, on the other hand, we should discard what is worthless, but we must always bear in mind that the conditions of foreign systems are different from our own, and, in most cases, as regards naval administration, are copied from us. In any remarks which I may have to make upon this paper, I wish it distinctly to be understood that it is the *system* alone to which I object, and not the administration in any way whatever. On the contrary, I have every reason to say, from what I have seen when recently serving in the West country, that both the establishment at Keyham (which, however, has not been touched upon in this paper on the training of naval Officers), as well as the "Britannia," seemed to me, as far as I am able to judge, to be admirably conducted. Well, then, what are the grounds of my objection to entering Cadets at the age of 13 to 14½ by nomination, and placing them *en masse* under naval Officers in a harbour ship? And what do I propose to substitute in lieu? As to the grounds of my objection, I cannot call a better witness than the lecturer himself as embodying nearly all my views. He states that "the proper place for training sailors, practically, is the sea itself, and not a shore establishment, however good it may be." I say doubly and trebly Amen to that; that is exactly the whole point of my contention. He again says: "We have a large fleet scattered all over the world, so that we are able to distribute our Midshipmen in small numbers instead of crowding them all in one sea-going training ship, a system which he has always considered objectionable, and which has been tried and has failed in England." Now that remark, I will do him the justice to say, alludes to a *sea-going* training ship, but surely the arguments are equally applicable to a harbour training ship. But still with those two points in my mind, if we are of opinion that a lad of the age at which we should require to send him to sea (which I think should be from 15 to 16) requires technical knowledge in gunnery, torpedoes, the working of machinery, the handling of ships and boats, tactics (including signalling), and practical navigation—if he requires all this before he can be sent to a sea-going man-of-war—when alone *I* maintain he can acquire it—then I say the State is bound to give him that education; in fact, the State alone can do it. The question, however, is, do we require this technical knowledge in youngsters of 15 or 16? I say we do not require it, and another point is, we do not get it under the present system. Lads go to sea having, no doubt, been well looked after, but their knowledge in all these subjects is very vague, and

the other subjects can be as well, if not better, taught in a public school or workshop. Of course, the question is really where is the technical training to be got? I say at sea, and only at sea. Having satisfied yourself what amount of knowledge you require in a lad of 16, admit him by open competition, arranging your examinations so as to determine the direction and character of his preliminary training at school, send him to sea straight, and let his technical training commence there under the Lieutenants and Engineers. I entirely agree with the gallant lecturer that "Naval Instructors" being non-combatants should be allowed to die out. A lad should certainly serve at sea for four years (the first being on probation) as a subordinate Officer, that would bring him up to the age of 20, and at that age he should pass a Sub-Lieutenant's examination; something similar to the present one, but of shorter duration for preparation, and his education should not cease here, but should be continued, and the examinations in appropriate subjects should also be continued, before he is confirmed in the ranks of Commander and Captain. I think the lecturer is of the same opinion.

Admiral BOWDEN-SMITH: Examination of Commanders? Oh no.

Admiral CLEVELAND: I think there should be an examination of Commanders and Lieutenants. Before I sit down I must record my dissent from the gallant lecturer where he lays it down "that masts and sails are things of the past." There I know I am on one of my fads. I entirely disagree with him. There is an old saying "that you ought never to prophesy unless you know." Now I say it most emphatically, that before five years are over our heads, the professional opinion of our Service will insist upon our cruizers having ample sail as well as steam power, as it will conduce to the safety, efficiency, and economy of these ships.

Admiral Sir GEORGE WILLES, K.C.B.: I have on previous occasions used perhaps some strong language in this theatre on the subject of the education of naval Officers. I concur in everything that Admiral Bowden-Smith states in the paper he has just read. Admiral Mayne quoted me as having questioned the propriety of open competition. I have come to the conclusion that really it will not do any harm, and the sooner it is started the better. The competition is nominally three to one, but I believe they do not obtain the requisite number of boys to compete, whilst some who do not pass the test are given a second nomination; and not only that, but to my knowledge, boys who have not passed at all are allowed to enter the Service. I say if that is the case, the sooner we commence open competition the better. It has existed in the Army for many years. Speaking in the presence of my friend Sir Beauchamp Walker, for many years Director of Military Education, I expect that on the whole the system has been beneficial to the sister Service.

Admiral Sir E. G. FANSHAWE, G.C.B.: Admiral Mayne alluded to me as having written some sixteen years ago on the subject of naval education. I am not prepared to go into the subject of the naval education of the present day, before this audience, not having satisfied myself beforehand what I should say by study of the state of education at the present time. I certainly did think at the time referred to, when I was interested very much in the question, that it was absolutely necessary that we should increase the age at which young Officers went into the Navy. I think, when you consider that the whole education of boys from 14 to 19 is occupied in every civilized country with training their minds by continuous study—that to go into the "Britannia" at the early age of 12½ or 13 for two years, to go away with a certain knowledge of navigation, &c., and then to go into ships where there were Naval Instructors, but where the actual school work done during the day amounted, as I was told on enquiry, generally to not more than an hour: when you compare such education as that extending over an average of not more than an hour a day—in ships where it was carefully attended to—with what is required of a boy who is being trained to make an educated man elsewhere, there was a very great hiatus in the training given in the Navy. Elsewhere it is deemed necessary, in order properly to cultivate their immature minds, that boys should attend at school for some hours every day, and that their attention should be devoted continuously to certain subjects; but the duties of a Naval Instructor on board could not be carried out in anything like the same way, because the boy himself had to be doing other things in the ship which interested him more, and could not give his whole attention even to his short school work. That being so, I think I should

not have used too strong a word had I said that the system, as a system of education, was a rotten one. They came to the College at or after the age of 19, many of them knowing no more of navigation or of nautical astronomy, or things that they had learnt in the "Britannia," than they knew when they left the "Britannia"; in fact, an appreciable time out of the six months which were supposed to be given to higher education was occupied in reteaching the rudiments of navigation. Since that time the age of entering the boys in the "Britannia" has been increased, and the question is whether it is better that a boy should pass his time from 14 to 16 in the "Britannia" or whether he had better be left in a school receiving the general education given to gentlemen's sons in this country. That is a question before us. I rather did lean to the opinion, when I was more thoroughly acquainted with the current education in the Service ten or fifteen years ago, and entries were at an earlier age, that they had better stay at school. The age of entry has been changed, and I have no doubt whatever that the education of the Navy is very much improved in these fifteen years. I hope, whatever is done, it will not be forgotten that the small boys sent into ships in more recent years were not learning their profession in the same way as our worthy Chairman and I were when we went to sea. In everything that we did, all day long, we were learning our profession; we were appointed to boats, those boats went out whether it blew high or blew low. You might see fifty boats working in or out of harbour when a squadron was at Spithead; now you see steam launches. We were stationed aloft and saw how the sails were reefed and shifted and the spars were shifted; and thus we used to learn our profession, so that when we came to keep watch we knew what was going on. These boys in the iron-clads at the present day are not learning anything that can be called their profession in the same sense; and therefore, I was, I say, of opinion that they had much better be at school. But whether at the present advanced age the school should be the "Britannia," or whether the boys had better stay at the general schools of the country, is a point that I do not feel I ought to give an off-hand opinion upon, not having an accurate knowledge of the working of the existing system.

Admiral Sir ERASMUS OMMANNEY, F.R.S.: I have listened with pleasure to the very common-sense and clear description given by the lecturer on the training course on board the "Britannia." "Things as they are are very different to things as they were," under the altered conditions of ships and the Service. If any change should now be required I am a strong advocate for restoring the College in Portsmouth Dockyard, which is surrounded with everything that is interesting connected with the naval profession. Ships are to be seen fitting out and refitting, docking and undocking, going in and out of harbour. Spithead is the resort of all classes of ships, including foreigners and yachts, shipbuilding is always in operation, there is the great steam factory where valuable information can be acquired, likewise the gunnery establishments now combining every branch of instruction in naval artillery and drill. You should bear in mind that the above establishments did not exist in the old college days, there is also an observatory which can be made available for instruction in astronomy—the sail making and rigging lofts would also be accessible to youths for instruction. I think that the age for entering the Navy afloat should not exceed 15 years. Early impressions of sea life and self-reliance I consider as being essential. Many details of the seaman are acquired in youth which in more advanced age are not easily enforced, and I believe that obedience and discipline become more deeply rooted in mind and habit in youthful days. Having entered the Service at a very early age, when in advanced rank I availed myself of the privilege to study at the Royal Naval College. I well remember the enjoyment and information which were derived when in my daily rambles about the Dockyard and its establishments, therefore I conceive that any youth possessing a natural instinct for seafaring life would imbibe ten times the amount of nautical ideas and practical knowledge at Portsmouth than from the surroundings of the "Britannia." Circumstances and early responsibility contribute materially towards the future of an Officer. When a Mate I was put with three others into a brig commanded by a Lieutenant, without any special navigating Officer, and we were employed carrying the mails between Falmouth and Lisbon, necessity compelled us to be responsible for the safe navigation of the vessel. The experience I then

gained gave me a delight in navigation, which proved of inestimable benefit to me after I was in command, especially in parts of the world where skilful navigation was required. Taking all the advantages which are to be found at Portsmouth, I consider it the most desirable locality under the altered conditions for training our Cadets. It appears that the "Britannia" system of training has fulfilled its object up to present times, but now that we have entered into such a complete transition in all naval matters afloat, I think it necessary that the locality for the training of naval Cadets should be altered. Much credit is due to the Admiralty for the excellent arrangements provided at Greenwich College, where Officers of advanced rank acquire a good amount of scientific knowledge which has contributed materially in creating the high standard of Officers now on the Active List of the Navy.

Rear-Admiral P. H. Colomb: We have had a great deal of talk on the manufacture of the pudding; I wish to say a word or two as to the eating of it, because one has always understood that that is the proof. The point is, it seems to me, what sort of Officers does our system turn out? I do not know any better Officers turned out under any naval system than our own, judging from what I see. I know this, that our own naval Officers are not so much men of the world, perhaps, as those who have spent a longer time at school, and possibly, also, a longer time on shore; but I think the lecturer rather inferred, and I am inclined to agree with him, that that is something which we ought to preserve, because it means simplicity of manners and that simplicity of character which always has been the mark of the English naval Officer. I do not know, really, that our Officers at the present time have any marked defect except that one which has been dwelt upon by the lecturer—the want of acquaintance with foreign languages. But then we have to recollect that of late years the Admiralty have given such opportunities for Officers to study foreign languages as young Lieutenants, that we do not rightly know what they will be when the system gets thoroughly into work. At present, the number of Lieutenants is so small that Officers are kept continuously at sea; they have not the opportunities which presently, when the lists get larger, they will have, and I suspect we shall see the arrangements of the Admiralty put to very good use indeed, and that the character of the English naval Officers' knowledge of foreign languages will be proportionately raised. A great deal is said about the question of nomination *versus* open competition for entry; I do not believe myself it matters very much. I do not quite go with the lecturer in thinking that there are many men in the world too proud to write to the First Lord and ask for a nomination; I have never come across them yet, though there may be such people, and I believe the pressure upon the First Lord has never been great, and is not great at this present moment, and that, practically, every parent who is in a situation to put his son into the Navy, and keep him there, can get him in if he is fit. Therefore, my mind is open upon the question of nomination or open competition. I do not think if you had open competition to-morrow it would make very much difference; I do not think it is really a question of importance. I have two sons, one who passed in the days when the test was restored, and another who passed in by competition. So far as I can judge, it was exactly the same with each of those boys, and I gather, generally, that the numbers who fail to pass the test in those competitive examinations are so great that afterwards there is really very little competition; and that when we talk of a strain upon boys, a strain in competing which does not exist when they are passing the test, we are using words of no real force. Preparation for the Navy is most of all done by the crammers, and if you had open competition people would send their sons to the crammers just the same as they do now, and there would not be any very great difference. In regard to training for engine work—mechanical training—that is greatly on the increase. If I am not mistaken, it is part of a Midshipman's examination that he must know something about it now, and that they are bound to spend a certain time in the engine-room, and to understand how to run steam launches' engines. The real weak point of the whole of our system at present is that which has been touched upon—the naval instruction system—and I frankly own that I do not know how we are to get out of it. At present, a boy goes to sea in a ship to learn principally his duties as an Officer on board ship. For a good part of his time he is shut up in

a bad schoolroom learning what he would learn much better in a good schoolroom. Again, the naval instruction system tells very much against some boys, because there are Naval Instructors and Naval Instructors. If a father knows enough of the Service to find out where a good Naval Instructor is, and is sufficiently skilful in diplomacy to get his son there, the boy has a great advantage over another boy who happens to get with a bad one, which would not be the case if there were any general system of training. Boys, at present, do lose a certain amount of early charge of a watch that we used to get in a small vessel. I myself had charge of a watch from my third year of service. I got that advantage, but I lost the great advantage which exists from serving in large vessels. I have been very pleased to find that that which so many of us felt so much, viz., that pure mathematics had been raised to too high a standard and too much made of it, seems to be passing away. I understand that now, at Greenwich, for a young man preparing to become a Gunner or a Torpedo Lieutenant, the examinations are so arranged that all those who have a capacity for very high mathematics may make their marks in that way, but that others who have not that high capacity can make their marks in the allied sciences —physics and chemistry. I think that the conduct of those Lieutenants who were in charge of torpedo-boats in the late manœuvres is very strong presumptive evidence that we cannot be very far out in our education. We had examples of dash and pluck and go in the command of those torpedo-boats, which we do not find anywhere else, as far as I know. Possibly one is getting old and does not like change; but my own feeling is that I would leave well enough alone, simply turning it from point to point, slightly raising the age as it has been done, in introducing the chance of studying languages, and again in the reduction of the great standard that mathematics originally took.

Chief Engineer J. LANGMAID, R.N.: I gathered from Admiral Cleveland's remarks just now that, besides doing away with the "Britannia," he would like to do away with the Engineer Students' College at Keyham. I think that would be a very great mistake. The system was tried about forty years ago of training Engineer Officers in the engine-rooms of sea-going ships, and proved a failure.

The CHAIRMAN: This paper does not propose to do away with the Engineer College.

Chief Engineer LANGMAID: I was referring to what Admiral Cleveland said. I do not think an expression of opinion from an Officer of Admiral Cleveland's rank should go without some notice. The system of training Engineer Officers in sea-going ships was tried, and was found to be very unsatisfactory, as it must be. I consider that our system of training Engineer Officers at Keyham is about the best you can possibly have. It is impossible to give them the education in an engine-room that they get in a factory, where they are taught all the details of engineering trades in separate shops by competent instructors. They go into the drawing office; they learn engine design and machine construction, and are thoroughly taught in all branches of engineering science that could not be done at sea in any possible way. This instruction lasts for five years, and the Engineer Officer then goes to sea as an Assistant Engineer. His instruction in the engine-room then begins. The Chief Engineer takes the Officer as his assistant and trains him in such a manner that after three or four years he is competent to take charge of a watch, or possibly of a small vessel's machinery. I should be very sorry indeed to see that system altered.[1]

Admiral CLEVELAND: My objection to Keyham College was based upon this, that you can get exactly the same men out of a private workshop. I do not think the training given there is part of naval education.

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[1] Besides the really good engineering education an engineer student gets at the college at Keyham, he learns other things which may not show in an examination paper, but which make him likely to become a good naval engineer Officer in a much shorter time than a privately trained student. He learns habits of discipline, company drill, rifle and cutlass exercises, boating, swimming, ship construction, torpedo and other fittings of war-ships which cannot possibly be learnt in any private establishment.—J. L.

Admiral Sir J. CORBETT, K.C.B.: I was four years in command of the "Britannia," and, during three years out of that time, Admiral Bowden-Smith was commander of the ship. I had not the paper that he has just read before me until I came into this room, and I can hardly undertake to make any remarks specially upon it. I am, however, perfectly willing to say that I entirely agree with what Admiral Bowden-Smith has placed before us. There is one question about the extra age at which Cadets leave the "Britannia." I was always of opinion whilst in the "Britannia" that Cadets when they left the ship were quite old enough, and I think if you increase the age you should do away with the "Britannia," and put them on shore at a college. I do think young Officers before they go to sea ought to have some sort of training of the same kind that they get now to qualify them to be on board ship, and enable them to be of some use when they get there.

Mr. ANDREW CUNNINGHAME, M.N.: I was not aware of this lecture until this morning. It is a subject in which I take great interest, as I spent two sessions at the Royal Naval College, Greenwich, in the course of my career. I have always felt, both in my observations of the Merchant Service and of the Royal Navy, that the age at which boys went to sea was far too young. I have a very strong feeling that way. The lecturer, I think, mentions that one of the reasons is that it is necessary to catch a youngster in time, or else you would not get him at all if he knew what he was going to. That looks to me very like "falsehood, fraud, and wilful imposition," or, in other words, taking advantage of a youngster's ignorance and inexperience before he can judge for himself. I feel very strongly it would be much better to let the boy continue his general education until he was several years in advance of the 14½ limit, and then he will be better able to judge whether he is fitted for the sea or not. The lecturer mentions the American Navy, that after four years about 52 per cent. of the youngsters resign or give it up altogether. I think from the tone of the remarks made here, it has been assumed too much that a sailor can be made. I say that he is born; that you cannot make a sailor. I think he should be allowed to carry on his general education until he is seventeen or eighteen years old before he goes to sea, and if he has a desire then to go to sea he would probably make a good sailor, because he knows he has no time to lose, and he will apply his mind to his work much better than he would coming in at an earlier age. It appears that under the present regulations a young man of twenty can get qualified to take charge of a ship's deck. I should be very sorry to see any man of that age in charge of my ship's deck; because, considering the value of the property which is now committed to the Officer on watch, I think it requires a man of very mature mind, with all his wits about him, to be able to take that in hand. Another point, which is not brought out so much as I expected it would have been from the title of the paper, is with regard to the training of Officers. It has always seemed to me a weak point that there is so much time spent on half-pay in the Service. Only the other day I saw in the newspapers that the Commander of the ill-fated "Serpent" had been two years on half-pay before he received his appointment in June last. I think that is a serious difficulty in the training of an Officer, and I have often thought it might, with advantage, be arranged for an Officer under such circumstances to take or get some experience in the Merchant Service. I think there would be no difficulty in making arrangements whereby an Officer should be allowed to see something of the conditions of Service on board a merchant ship. It would qualify him very much better for undertaking the work of commanding in store for him in his own branch of the Service afterwards. With regard to our engineering friends, I do not think that they need be under any apprehension of being "abolished" by the Captains. The tendency, I think, both in the Merchant Service and the Royal Navy is the other way, that the Engineer will "abolish" the Captain, that is, the Captain of the ship will have to be an Engineer. As a sailor myself, I always felt that the Captain ought to be the best man on board his ship, and for that reason I do not see that a Captain of a steamship can be properly qualified unless he is a thorough Engineer, and, more than that, the man who can pass an engineering examination can certainly qualify himself to handle a ship of any description.

Admiral G. S. BOSANQUET: I should like to make a few remarks that practically bear upon this question, without entering into details. It appears to me that the

able lecture we have heard from Admiral Bowden-Smith had somewhat of an apologetic turn. His argument appears to be to let things drift as they are until we can find out something better, and he has given us a good many quotations from the details of foreign navies, as to what is their particular system. But I will argue the question thus: I will go back to the Navy of our own time—that is of the time when I entered it—there are many Officers older than myself, and of my own standing, also here present. Let us compare the training of Officers and their capabilities under the old system with what now exists. Admiral Bowden-Smith says, "Surely you cannot wish to see young Officers go straight on board ship from school at the age of sixteen or seventeen, and take their place as Officers without any preliminary training." He says they would not know signals, they would not know the management of boats, &c. Now, in the ironclad that I commanded, a great number of cadets passed through my hands every year; a large number being drafted straight from the "Britannia"; and what did I find amongst the boys? They all said, "The conditions of life are perfectly novel to us, we did not expect it, nor did we know anything about it." After so many months of training there were periodical examinations that I used to hold, and I found that their knowledge of seamanship, which I presume is the *raison d'être* of the "Britannia," was absolutely *nil*. I do not mean to say that they could not turn into a hammock, although even in that case they found it was twice as high to reach as on the "Britannia." Still there was nothing as regards practical seamanship which they had acquired, and I ask how is it possible that boys can learn what you call seamanship in a ship of that kind? When they got on board ship they did not understand what a real rope was, or anything else real. The consequence was, you may say, there was very little to show for their education as regards practical seamanship. Then let us take the Officers of my own standing, of whom there must be a large number here, as well as many older Officers. Take myself for instance. I entered at the age of thirteen. I knew positively nothing. I went on board: the first night I kept my watch. The next day I had to go away in a boat to the flagship to copy orders, but I knew no more about steering a boat than the man in the moon. But having to do it, the result was, that in a month's time, I was perfectly capable of handling a boat, and could sail her perfectly well. Therefore, I may say, I was quite as efficient an Officer as any boy who comes from the "Britannia" at the present time, after his two years' so-called seamanship training. Then, I ask, what are we in the Navy for, what is the object of our profession? The object is to handle your ship (or a fleet) and carry her into action; to handle your ships as I believe they never are handled elsewhere. Has it not been so from the earliest ages? Is it not the fact that the Admiralty in past times were able, whenever it was necessary, to select Officers for any specialty, scientific or otherwise, even apart from seamanship, with the very highest attainments? Many Officers have now passed away, having the very highest scientific attainments—men like Admirals Shadwell, Shortland, Ryder, and many others, and some such are present now. Therefore, the question is, are we getting any better material now, or attaining our object better than we did before? No doubt there were faults in the past system, and they could be corrected, but it appears to me, and in that I find myself in agreement with what has fallen from Admiral Cleveland, that when an Officer joins the Service he should go straight to sea. I take it that a great deal of Admiral Bowden-Smith's paper does agree with what Admiral Cleveland has said, and that, although he says, "Keep on the 'Britannia,'" his argument is against it. It was not until I actually knew that I had to learn languages that I did apply myself to them. I was too young to learn them at first at all, and so it is now. Admiral Bowden-Smith told us himself that the British boy won't learn French, and yet you see that as very recently certain advantages have been held out, by the Admiralty, to those Officers who will take the position of interpreter, and that Officers must qualify for these things, that many do so and many more will in course of time. Let every Officer have the standard set before him, and he will acquire it in time. There is no doubt about that. It has been so in the past, and it will be so in the future. Give the standard, and do not stop examinations at that for Sub-Lieutenants at the time when the brain power is just beginning to be at its best; but follow up your examination in the higher ranks, either by passing through a

Staff College or elsewhere, and let these examinations be continued from Lieutenant up to the rank of Commander. That appears to me to be what the argument of Admiral Bowden-Smith would lead to, because he says that at the immature age of the boys they wont qualify as regards languages, and as it is with languages, so as regards everything else. I am strongly in favour of throwing the whole into open competition at the age of sixteen. I do not see why, at the age of sixteen, there is something peculiar in a boy, so that he should not be able to adapt himself to his profession as well as coming from the "Britannia," at the age of sixteen, when he has a very rude smattering and nothing well grounded, as regards seamanship. With regard to the system of educating young Officers on board their present ships, it appears to me that it is an endeavour to put into a pint bottle the contents of a quart bottle. They are driven from pillar to post. It is incessant grind, and nothing thorough is done. Our Officers attain to their qualifications, and become as good Officers as they are, and I have no doubt they are in many respects as good as those of the past; but they do so in spite of the system and not because of the system.

Lord ROBERT MONTAGU: Admiral Mayne has told us that a boy should go straight from a public school on board ship; that is to say, he should have no naval education. He may learn what everyone learns at a public school; but he is to have no naval education until he goes on board. Another speaker, who, I believe, was also an Admiral, because he spoke with authority, said that in no ship can a boy get more than an hour's education a day, and that in most ships they do not even get that. Now, we seem to be here in a sort of difficulty. Admiral Mayne says, give boys no naval education until they go to sea; the other Admiral says, that when they go to sea they will not get an hour a day, and nothing like it. How then are they to get any naval education at all? To get out of that difficulty I think some change is required, and I would like to mention a change that has been tried. I daresay you remember Commander Hoskyns, a brave man who jumped overboard to save a poor Indian girl in the Pacific from being eaten by sharks; the result being that he got rheumatic fever and died. Before he went to sea in the "Swiftsure," he went to the Admiralty, and said that boys should not keep watch, that it stopped their growth; but that they should attend school instead, and he would like to try the experiment. The result was that they kept no watches, until their homeward voyage this year, and had four hours of schooling a day. My boy was on the "Britannia," under Admiral Bowden-Smith, and he came home with the highest admiration for Admiral Bowden-Smith. Yet I suppose he learned a good deal on the "Britannia," as he came away having gained five months of sea service. Then he went to sea, having had a naval education before he joined the "Swiftsure"; and while at sea he had four hours schooling a day. It seems to me that is a great deal more to the purpose, under the present system, than to accept Admiral Mayne's principle. I thank you very much for having listened to these few remarks, and I thank Admiral Bowden-Smith for his extremely instructive paper.

Admiral LE HUNTE WARD, C.B.: I desire to express my entire concurrence in, I think, everything which has fallen from Admiral Mayne on this subject. I am told that unless I am prepared with a cut and dried system I ought not to express objections to the system now existing, that is to say, I ought not to pull down unless I am prepared to build up. This principle is right if that which now exists cannot be shown to be positively vicious, but I consider this to be the case in the "Britannia" at present, and that it is so by the showing of its own advocates. Its own advocates tell us that they could not obtain Officers for the Navy except under the false pretences now in vogue, that is to say, that young gentlemen be required to enter the Service at an age when they are incapable of judging for themselves whether they are in any way fitted for the Navy or not; and the result has always appeared to me to be eminently unsatisfactory, and I believe that they would turn out far better Officers if they were allowed to continue in their schools and to gain the advantage of what I consider to be the very best education in the world—that of our public schools. And, moreover, I cannot think for one moment we should find any difficulty in filling up the ranks of Officers of the Navy. For where are our young Officers to go if they do not enter the Army or Navy, or any of the

learned professions? If they find themselves stranded on the nothing-to-do bank, they have to go to the Colonies. And we can all judge which would be the hardest life, making their way with their back to the wall in the Colonies, or entering Her Majesty's Service; I am quite sure that the hardships which they would have to endure on board the ships in the Navy are nothing to be compared to the hardships, coupled with uncertainty of result, which they have to put up with when they go to the Colonies.

The CHAIRMAN (Sir Houston Stewart): Ladies and gentlemen, as it is now more than half a century since I entered the Navy, a boy in my fourteenth year, I do not think any opinion of mine as to what system is the best suited to the present requirements of the Navy would be of any value. But my own experience is always present to my mind when I look back upon my early days afloat. I came to sea, without any examination, direct from school, in the previous years being educated by a tutor at home. It is due to a father who attached the greatest importance to education himself, and who, having had but little education in his early days in the Navy, attended the college classes at Edinboro' when he was spending that time which has been characterized by one of our speakers here as the rather "idle time" of half-pay, and had his education completed in its higher branches, to state that I was, for my age, very well educated, a good classical scholar, very well grounded and advanced in history, geography, English composition, and astronomy, fairly well acquainted with Euclid, fair knowledge of arithmetic, and of mathematics nothing. In the same ship I had two young messmates who came from the Royal Naval College: to my mind it appeared that they knew everything that was necessary to know about a ship. My position was very much what Admiral Bowden-Smith says in paragraph 3. I knew nothing of signals or the management of boats, and for the first year I must say I think I was rather useless, certainly compared to these young collegians, who at once took part in the active duties of the ship. I am not comparing the system of the "Britannia" now. I do not know what the boys know in seamanship when they leave the "Britannia," but I can clearly recollect what these two messmates of mine knew of seamanship when they left the Royal Naval College and joined the "Tweed" with me. They were perfectly acquainted with knotting, splicing, the names, leads and uses of all ropes, rigging, reefing and furling, tacking, wearing, working anchors and cables, taking meridian altitudes, taking sights for the chronometers and working them out, and taking lunars, with the management of boats under sails and oars. Soon after we left England, in the chops of the Channel we carried away the fore topsail yard, which had to be shifted, and we three youngsters were ordered into the fore top. I shall never forget holding on by the main topmast stay, a bewildered observer of what was going on around me, while these two youngsters were skipping about like monkeys, and taking an active part in the shifting of the yard. It was a constant subject of regret and humiliation to me that I found my messmates acquainted with things of which I knew nothing, and often did I wish that instead of passing direct from school to the ship, I had had some previous professional training, the same as these youths had, in the College. Among other things, they sketched well, and were good in making track charts. That is all I have to say on the subject. Looking back on my past career, which has been a singularly fortunate one, I still regret that I had no professional training before I entered the Navy.

Captain JOHNSTONE, R.N.: Will you tell us the age of your messmates who were at the College?

The CHAIRMAN: They must have been 15; they had passed two years at College.

Admiral MAYNE: They were three years older than you when they showed this proficiency?

The CHAIRMAN: Yes.[1]

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[1] Here I am wrong: instead of 12, I should have stated that I was in my 14th year when I joined H.M.S. "Tweed," at Portsmouth in April, 1835.—W. H. S.

Admiral BOWDEN-SMITH: Before attempting to make a few remarks on the observations that have been so kindly made, I should like to say I feel I ought to apologize for asking you to come here to listen to what many of you must think a very meagre paper on a very important subject, but I have been misunderstood, as I never intended to go into the engineer questions or into the consideration of the higher education of naval Officers. When Admiral Mayne kindly read his paper here, I thought it well that some Officer on the active list should reply, and having been Captain of the "Britannia," and having personally visited several of the foreign training establishments, I rather hurriedly wrote this paper, which I hoped to get in during the season, but I was too late, and that is the reason it comes out now. Had I known it would have been so long delayed, it possibly would not have been written at all. I am very glad Admiral Mayne says he does not object to the "Britannia" as a school, but only to the system. I am much obliged to him for saying so publicly here, because if naval Officers speak disparagingly of the school, it tends to dishearten the permanent staff of the "Britannia." He says he does not object to the "Britannia," he thinks it is a fairly good school.

Admiral MAYNE: A very good school.

Admiral BOWDEN-SMITH: I am obliged; but what he does object to is that Officers are not now efficient.

Admiral MAYNE: No.

Admiral BOWDEN-SMITH: Then I am very much puzzled. The "Britannia" is a good school, the Officers are efficient, then why do away with the "Britannia"? I suppose Admiral Mayne's argument is that if youngsters came straight from school, instead of going to the "Britannia," they would be more efficient than they are now?

Admiral MAYNE: Yes, I think that they would be, as a general rule, more efficient. They would come in with every kind and variety of early training, and would be more what they used to be without this waste of time and money on the "Britannia."

Admiral BOWDEN-SMITH: It has been said by Admiral Mayne and Admiral Cleveland that I referred to foreign navies as if I wished to adopt their customs and principles. It was not at all so; I only gave those facts thinking they might interest my brother Officers. I say, by all means, compare foreign systems with our own, and if any are better than our own, adopt them. I should like to show you, however, how impossible it is, in some sense, to compare our training with that of foreign Officers,—our habits are so different. If I may compare the "Britannia," for instance, with our good friends' and neighbours' ship the "Borda" at Brest: during the hours of recreation, we permit our cadets to have access to all the leading newspapers, periodicals, and books. On the "Borda" they do not allow any newspapers on board. Should we approve of that sort of education? I think not. On the "Britannia" we oblige the cadets to go on shore every day for recreation, hoping that they will go in the boats, or play at cricket, or football, or other manly games. On the "Borda" the French cadets are only allowed on shore every alternate Sunday, and do not always take advantage of that. Admiral Cleveland says I am apologizing for our system, and that I am of his way of thinking, because I said the real place for training naval Officers is the sea itself. I do say so, but not till they are sixteen, and before they do go to sea it is a great advantage to them to have some preliminary training to know how to handle nautical instruments, to know something about boats and various other things. My friend Admiral Bosanquet says that they do not know anything. Well, perhaps I may be pardoned for saying if they do not know anything it is partly the fault of my brother Officers. When a batch of cadets come on board ship and really do not know anything, if the Captain of that ship would only write to the Admiralty and say "That a batch of cadets did not know anything," the Captain of the "Britannia" would hear of it, and, possibly, the next batch might know more. I protest against that statement made by Admiral Bosanquet. The boys, of course, do not know how to handle a ship, but they know how to manage a boat, are well up in signals, and know many other useful matters. When I went to sea I went straight from home, and knew nothing. On board the ship was a master's assistant from Greenwich who was able to take his

place at once and make himself useful. It is a great advantage to boys before going to sea to have this education, and with regard to the "Britannia" as a school, if you except the classics, you get an exceedingly good general education on board, and several gentlemen have told me that even though they did not intend to send their sons to sea, they would choose that as a school in preference to many others. The cadets are really made to work, when at public schools they are not made to do so. Admiral Mayne referred to the question of expense. There is a great misconception, I think, on that point. The estimate for the "Britannia" was 20,000*l.* this year, and the contributions by parents 16,000*l.*; but that estimate does not cover the wages of the crew nor the maintenance of the ship. The wages of the crew should not be taken into consideration, because the Officers, seamen, and marines are all available for the fleet; if they were not there, they would be at Portsmouth or Plymouth; so that really the ship is not such an extravagant establishment as some people imagine, but even if she were, I think England can afford to pay for it. One gentleman says, take the American Navy as referred to in my paper, and say there are 52 per cent. resign. Why? Because they have to. They enter 100 boys in their training ship when they only want 25, and the other 75 have to go. It is not a matter whether they like it or not.

Mr. CUNNINGHAME: I misunderstood you; I thought that referred to those who felt themselves unfitted for the profession.

Admiral BOWDEN-SMITH: Admiral Bosanquet says my idea seems to be to let things drift. Not at all. I always advocate any change if for the better, but I do not think the change recommended of boys going straight to sea from school would be a good thing, and with regard to the Officers of the present day, I have no hesitation in saying the Lieutenants are far better now than they were in my young days, far better in every possible way. I have now only to thank you for your kind attention and criticism, and you, Mr. Chairman, for so kindly presiding.

The CHAIRMAN: There has been a difference of opinion on this subject, as on all others. I do not exactly know which has the majority, but I am sure you will all be in accord in giving our best thanks to Admiral Bowden-Smith for his very clever and interesting paper.

FOREIGN SECTION.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

ON BELLEVILLE BOILERS AND THEIR APPLICABILITY TO OCEAN-GOING VESSELS.

Translated from the Russian Naval Magazine for July, 1890, by Major WOLFE MURRAY, R.A.

IN the course of the last ten to twelve years, with the constant increase of steam pressure in boilers for engines of, at first, double expansion, and, subsequently, of triple expansion (with the latter of which trading vessels and war ships have been exclusively supplied of late years), it has been observed that the life of the boilers has become shorter and shorter, especially with pressure in excess of six atmospheres. The destruction of the boilers has arisen chiefly from leaks in the seams of the furnaces and of the fire boxes. Even with conscientiously made boilers it frequently happens that furnaces, fire boxes, and tube plates have to be renewed after three years' service. These costly repairs—for in the case of such repairs only the cylindrical body of the boilers and the flat plating at the back remains intact—necessitate the idleness of the vessel for a considerable period of time. Accordingly, in 1884, the Messageries Maritimes determined to try Belleville boilers, and ordered from the Belleville works boilers for their new vessel the "Ortegal," then under construction.

The steam transport "Ortegal" was launched in 1884. Her hull and engines were built at La Ciotat, near Marseilles, at the yard and works of the Messageries Maritimes. The boilers were made at St. Denis, near Paris, at the Belleville works.

Length of vessel		337 ft. 10 in.
Width		45 „ 5 „
Draught, fully laden	bow	19 „ 4¼ „
	stern	22 „ 0 5/16 „
Displacement, fully laden		5,850 tons

Engines and Boilers.

Diameter of small cylinder	$36\frac{5}{16}$ ins.
„ large „	$64\frac{5}{16}$ „
Stroke of piston	$43\frac{5}{16}$ „
Steam pressure	6 atmospheres
Cut off	from ·24 to ·42 the stroke of the piston.
Number of boilers	8
Space occupied by boilers along the length of vessel	32 ft. $7\frac{7}{8}$ ins.
Length of tubes with boxes	6 „ $0\frac{3}{16}$ „
Area of grate surface { original	243 sq. ft.
Area of grate surface { diminished	180·9 „
Heating surface	6,943 „
Steam space in boilers	301·56 cub. ft.
Water space „	96·93 „
Number of furnace-bars	384
Diameter of funnel	7 ft. $2\frac{9}{16}$ ins.
Height of funnel from grate-bars	58 „ $4\frac{3}{4}$ „
A casing along all the height of the funnel and distance between the sides of the funnel and the casing	1 „ $1\frac{5}{16}$ „
Interior diameter of safety valves	$1\frac{15}{16}$ „
Number	16

The trials of the engines and boilers of the vessel were carried out from 11th to 25th April, 1885, and the runs on the measured mile gave the following results:—

Number of revolutions	81·90
Speed in knots	13·38
Indicated H.P.	2110·50
At this trial the mean draught was	14 ft. $2\frac{1}{4}$ ins.
Difference	4 „ $7\frac{3}{4}$ „
Area of immersion of midship section	521·32 sq. ft.

Service on Board the Steamer.

The first trip was from Marseilles to London and back, from 8th to 29th May, 1885. In the course of this trip the steamer was under steam 396 hours, including blowing off and getting up steam, and the total run was 4,146 miles.

When the vessel started, both from Marseilles and from London, the boilers were filled with fresh water, and during the trip the inevitable loss of water in the boilers was made good by taking in sea water. The blowing off of the boilers was carried on uninterruptedly, and although the saltness of the water did not exceed 6 degrees (with the salimeters used in France 0 degree corresponds to the density of distilled water, and 10 degrees to the density of water completely impregnated with salt), saline deposits occurred on the lower surfaces of the four lower rows of tubes. On the run from Marseilles to London twenty tubes were burnt; and the leak of each burnt tube resulted in a diminution of steam in the boiler, to which the burnt tube belonged, for the time requisite for patching up the tube. On arrival in London the inner surfaces of the tubes were inspected, and saline deposits of five-sixteenths of an inch were discovered on the lower surfaces of the tubes. On the return journey from London to Marseilles the same features made their appearance, and again twenty tubes were burnt.

This experiment of making good the inevitable loss of water in the boilers by filling up with sea water, even on an uninterrupted run of only 2,000 miles, appeared to be thoroughly unsatisfactory, a conclusion in which

M. Belleville was compelled to acquiesce; for during the above trips from Marseilles to London and back again an engineer from M. Belleville's works was on board, and it was, therefore, impossible to ascribe the unsatisfactory results to the carelessness of the engineers of the "Ortegal." The "Ortegal," however, never made a trip from France to South America and back, trying her boilers exclusively with sea water, as M. Dubuis stated before the Naval Technical Committee.

Repairs to the Boilers after the above Second Trip, Alterations and Refitting of the Boiler Apparatus, and also Supplementary Work and Fitting for Ensuring the Supply of the Boilers exclusively with Distilled Water.—From the 8th June to 11th July, 1885, that is, after the vessel had done 4,116 miles, feeding her boilers with salt water, the following alterations were carried out:—

a. The two rows of lower tubes in all the boilers were changed, but the original thickness of the tubes (5 mm.) were adhered to.

b. The water levels were reduced by 14 cm., and the direction of the feed water into the purifying reservoirs for the steam and for the feed water was changed. The funnel was divided into four parts, by means of a cross-shaped partition; each part served to carry off the products of combustion of two boilers. The capping of the funnel was lengthened.

At the same time, to diminish the loss of fresh water and to ensure the supply of the boilers with distilled water, the following measures were taken:—

c. In order to attain more complete combustion, air was passed into the furnaces instead of steam, an air-pump being erected for the purpose, which was driven by a beam, which set in motion an air-valve.

d. The water which accumulated in the jackets of the steam cylinders, that arising from the blowing off of the steam cylinders and valve boxes, that from the blowing off of the general purifiers, and also the water from the boxes of the safety valves, was taken away into the condenser or into the fresh-water tank.

e. The exhaust steam from the auxiliary engines was passed into the condenser.

f. A special condenser was constructed for condensing the exhaust steam from the auxiliary engines, when the main engines of the vessel were not working.

g. To make good the loss of water in the boilers, a distilling apparatus, with boilers and condensers, was fitted up. The water from the condenser was carried off into the fresh-water tank.

Service of the Vessel from 11th July, 1885, to 14th February, 1889.

With boilers fed exclusively with fresh (distilled) water, the "Ortegal" made two trips from Marseilles to London and back, one trip from Marseilles to Bordeaux, and ten trips from Bordeaux to the coasts of La Plata and back. In the course of these, *i.e.*, from 11th July, 1885, to 14th February, 1889, the steamer ran 112,807 miles, and was under steam 13,020 hours, or 542½ days; 1,908 hours or 79½ days getting up steam; in all 622 days with steam up.

Repairs to Boilers and their Appliances from 11th July, 1885, to 14th February, 1889.—*a.* Repairs from 7th October to 1st November, 1885.—The 100 patent furnace bars were repaired. The doors, closing the space in which the boiler tubes are situated, were lagged with asbestos and wood. The brick bridges of the boilers were repaired; 33 kilogrammes of zinc were placed in the boilers; the zinc is placed in the collectors of the feed water and in the reservoirs for purifying the steam and the feed water.

b. Repairs from 18th March to 11th June, 1886.—All the sections were taken out of the boilers; 520 rings at the junctions of the tubes with the

boxes, and 128 tubes were cut out. The two lower rows of tubes, in all the boilers, were replaced by thicker ones, viz., with 10-mm. tubes in place of 5-mm. tubes. This alteration was done at M. Belleville's instigation, but was not called for by the unserviceability of the tubes. The outer casings of the boilers and the smoke boxes were repaired, as they had become bent; the former, moreover, appeared weak, and had to be strengthened with additional angle irons. The area of grate surface was diminished from 243 square feet to 180·9 square feet, in order to make the combustion in the boilers more effective, and thus to increase the efficiency of the circulation of the water. An area of 180·9 square feet corresponds to 1,160 ind. horse-power, by developing which the steamer makes its long runs with a mean speed of 10½ knots. The cross-bars of the grates and the ash-pits were repaired.

Observations regarding the Working of the Belleville Boilers and Method of Looking After them on the Eleventh Journey of the "Ortegal" from Bordeaux to South America and Back.

This trip lasted from 16th February to 25th May, 1889. During the trip the vessel was sixty days under steam, throughout which the boilers and their appliances acted satisfactorily, with the exception of the injuries noted further on. During the passage the heel of the vessel reached as much as 25 degrees, and for two days the steamer was steaming against a fresh head wind, which reduced her speed to 5 knots.

Notwithstanding all this, though there was considerable motion, the engines acted satisfactorily, and there was no priming.

During the course of this trip the steamer ran with a mean speed of 10½ knots; the engines made about 68 revolutions, and developed about 1,160 ind.-horse-power. Generally seven boilers were used; the eighth boiler was only used when the coal was of bad quality.

The injuries on the run from Bordeaux to Buenos Ayres were—

a. The fusible plugs, which are retained in position solely by friction, were frequently driven out by the pressure of the steam. They were readily and rapidly replaced by spare plugs.

b. The flange of one of the feed pipes was torn off, namely, that flange by which the feed pipe is attached to the flat side of the separator for the steam and feed-water.

c. The connection for driving the air-pump was broken.

Cleaning the Boilers and Inspection of the Boiler Appliances after Thirty Days' Steaming.—From 18th March to 22nd April the steamer for the most part was lying in the ports of South America, as the passage between ports occupied only seven days, and only six boilers were employed. During the thirty-four days of the vessel's stay off the South American coast, the cleaning of the eight boilers was gradually carried out, and a portion only of the boiler appliances were overhauled, as on account of the limited number of engine-room hands, it was not possible to inspect all the boiler appliances. With regard to the cleaning and overhauling of the boilers and their appurtenances, the following points must be mentioned:—

a. Cleaning of the Boilers.—In each of the boilers the following were cleaned from the deposits formed in the separator for steam and feed-water; the four lower rows of tubes in each boiler and all the deposit was removed. The five upper rows of tubes are cleaned with scrapers only once a year, *i.e.*, after 180 or 200 days' steaming. When the boilers are cleaned, a deposit of 1 to 3 mm. is removed. The thicker deposit was found on the two lower rows of tubes, and principally in the central sections of the boilers.

b. Time required for Cleaning one Boiler.—When three stokers were employed for nine hours a day, three days were required for cleaning, washing

out, putting together again, and testing the boilers with hydraulic pressure, with the view of seeing that the ends of the tubes were satisfactorily set up.

c. Bending of Tubes and Boilers.—In cleaning the boilers it was clearly apparent that in all the boilers the tubes of the lower rows were bent, and that this was especially the case with the central sections. This bending constantly increases with the period of service of the boilers. In one of the boilers the bending of two of the tubes was considerable, and accordingly they were replaced by spare ones. In removing these tubes their washers and rings had to be cut out. After they had been taken out the amount of their curvature was measured, and in one case it was found to be 1 inch, in the other ¾ inch.

N.B.—In all the boilers the above curvature of the tubes is found to be in one and the same direction, that is to say, the convex surface of the tube is always downwards towards the fire grates.

d. Changing the Zinc.—In cleaning the boilers, all the zinc plates were renewed. These should be renewed approximately after twenty-five to thirty days' steaming.

e. The brick bridges for the boiler furnaces, after the run from Bordeaux to Buenos Ayres, were in a satisfactory condition: that is to say, in each furnace a few bricks had fallen out, and they were replaced in all the furnaces by new ones by two stokers in two days.

f. The automatic water-gauge cock of the separator, during the trip from Bordeaux to Buenos Ayres, allowed the water to rise 5 inches beyond the middle of the water-gauge. On taking the apparatus to pieces it was found that the float of the apparatus was partially filled with water, in consequence of the passage of steam into the junction of the float with the upright stem (the stem is screwed into the float). After the water had been driven out of the float, and after the upright stem had been firmly fixed by means of a new washer placed under the shoulder of the stem, the automatic water-gauge cock was put together, and it acted without failure in the subsequent runs.

g. The automatic feed apparatus were not inspected for want of time, and as they had acted accurately during the run from Bordeaux to South America, we confined ourselves to renewing the packing of their lubricating arrangements.

h. The "regulator-détendeur"[1] was taken to pieces, cleaned from dirt, and put together again. This work was done in one day, by three stokers.

i. The port Belleville donkey engine.—The pump of this donkey engine was taken to pieces, and it was found necessary to replace the piston rod of the pump. This rod is of steel, and has no bronze sheathing. It was found to be eaten away by the action of the galvanic current in that part of it which does not work in a lubricating packing; and on that portion of it which does work in a lubricating packing there were deep longitudinal grooves. This rod was replaced by a spare one, and this occurred a second time during the four years' service of the "Ortegal." The body of this pump is of cast iron, with a bronze lining. The remaining work was the same as in ordinary boilers, and therefore not worth detailing.

k. The condenser was tested with hydraulic pressure of 1 atmosphere, on arrival at Buenos Ayres, and it was found that some of the tubes leaked slightly; their collars were tightened, and the condenser was again tested by hydraulic pressure. At this trial of the condenser the inner surfaces of the tubes were carefully cleaned from the grease which had accumulated in them.

During the forty-eight hours' run from Buenos Ayres to Bahia Blanca, it

[1] This is elsewhere stated to be an apparatus peculiar to the Belleville boilers.—J. W. M.

was observed that the boilers did not require filling from the reserve tank of fresh water. This circumstance, together with the greater saltness of the water, gave cause for doubting the reliability of the tubes of the condenser, and accordingly, on the arrival of the steamer at Bahia Blanca, the condenser was again filled with water, and it was found that one of the tubes had got shifted in the direction of its length, and that one of its packings was leaking. As a general rule, on board the steamer it was laid down that the tubes of the condenser were to be looked to as frequently as possible, with a view of averting the possibility of any escape from the tubes into the packings. An inspection of the tubes is, moreover, compulsory on the arrival of the steamer in South America, and on her return to Bordeaux, *i.e.*, approximately after every thirty days' steaming. At these inspections the interior surfaces of the tubes are cleaned by hand by means of flexible rods. In the condenser of the "Ortegal" the steam is passed through the tubes, and the water circulates round the tubes.

The injuries on the return journey from South America to Bordeaux were:—

1. A considerable leak was observed under the nut of a steel bolt, which secured the bronze lining in the cast-iron cylinder of the pump of the port donkey engine from shifting in a longitudinal direction. To prevent the loss of fresh water this donkey was taken to pieces, the bolt, which had been eaten away by the action of the galvanic current, was replaced by a spare one. This work took a whole day. According to the statement of those serving on the steamer this was the second time this bolt had been eaten away in four years.

2. The flange of the feed pipe of one of the boilers, which runs from the graduated stopcock to the automatic feed, was torn off. After steam was lowered in this boiler, the injured pipe was replaced by a spare one.

3. Some hours before arriving at the Canary Islands a leak was discovered in one of the parts of the feed pipe, which runs from the port Belleville donkey engine, and which is situated in the hold. On inspection, it appeared that there was a small circumferential crack in the pipe, and near the flange. This portion of the pipe was shut off, and subsequently during the twelve hours' stay at the Canaries it was soldered.

4. On weighing anchor at Las Palmas, in the Canary Islands, a leak of water and steam into the furnace of the port bow boiler was observed; accordingly this boiler was disconnected from the others, and steam was lowered in it. On the next day, in order to fix the position of the leak, this boiler was filled with water, by means of the donkey, and when filled the leak was found to be from the fourth section (reckoning from forward), so that this section was removed from the boiler. On inspection it was found that the uppermost tube of this section had, on its lower surface, a hole $6\frac{1}{4}$ inches long, and $\frac{1}{4}$ inch wide, and so it was determined to replace this tube with a spare one. In order to remove the tube from the section, both the ring of this tube and the tube itself were cut off near the after uniting box, and the short portion of the tube which remained screwed into the plate was then cut off, and so, having flattened the portion of the tube which was cut off, it was screwed out of the box.

After the worn-out tube had been replaced by a spare one, steam was got up in this boiler, and it continued to work successfully with the others. Two working days were required for shifting the worn-out tube.

According to the statements of the commander and chief engineer of the vessel, who had served on her since she began her career, this eating away of the tube now occurred for the first time, that is at the commencement of the fifth year of the vessel's service.

N.B.—On a careful examination of the tube which had been eaten away,

after its removal, it was found that this eating away had already commenced in another place in this tube, also on the lower portion of its interior surface, and that in a short time a similar hole to that already discovered would have been formed.

5. It was observed that in blowing off boiler No. 3 on the port side, the movement of the water in the blow-off pipe was slow, and, therefore, it was decided to examine the ejector of this boiler. On steam being got down in this boiler, and, on the water being emptied out, the cap of the dejector was removed. Much mud was found on the bottom of the ejector, and the blow-off pipe, which goes down almost to the bottom of the ejector, was found to be stopped up with bits of zinc. After the ejector was cleaned and also the blow-off pipe entering into it, steam was again got up in the boiler.

6. Fracture in the connection which drives the air pump.—This fracture took place eight hours before the arrival of the steamer at Dunkirk, and necessitated the stoppage of the engine for three-quarters of an hour to disconnect this pump from the engine.

Salinity of the Water in the Boilers.—In spite of the feeding of the boilers with distilled water, and of the great care taken of the condensers, the salinity of the water reached 3 degrees, and recourse had to be had to surface blowing off of the boilers for a short time to maintain the salinity of the water at 2 to 3 degrees.

The Bottom Blowing Off was carried out twice in the twenty-four hours through the blow-off cock of the ejector. At each blow off the cock was rapidly opened and closed twice, and this was quite sufficient for the removal of the sediment which had accumulated in the lower part of the ejector.

Pressure of Steam in the Boilers.—Efforts were made to keep this at 8 atmospheres, which was effected when Cardiff coal was used. With other sorts of coal the pressure varied from 5 to 7 atmospheres. When the tubes were being cleaned by steam and also when the furnaces were being cleaned, the steam pressure, with bad coal, fell to $3\frac{1}{2}$ atmospheres.

The Quantity of Fresh Water required for making good the waste of water in the boilers, varied from 2 to 3 tons per twenty-four hours. An expenditure of 4 tons only happened towards the end of the voyage, for the apparent loss by leaking through the packings became considerable after ten hours' uninterrupted working of the engines.

Expenditure of Coal per hour per indicated Horse-power, and quantity of Coal burnt per hour per square foot of Grate Surface.—During my tour of service on the steamer three different sorts of coal were used, viz. :—1. Cardiff of the ordinary quality found in the trade. 2. Coal sold as Cardiff, and similar to it in appearance, but actually, as was found on burning it, something between Cardiff and Newcastle. 3. Cheap *briquettes* (15 francs a ton), which were obtained at Dunkirk. In order to attain the ordinary twenty-four hours' run of 250 miles, the engines must do about sixty-eight revolutions and develop about 1,160 indicated horse-power, and, under these conditions, using seven boilers, the area of grate surface of which was 158 square feet, the mean daily expenditure of coal was :—

a. For Cardiff of ordinary quality, 35 tons or 85,400 Russian funts, which makes 3 funts per indicated horse-power per hour, and gives a consumption of $22\frac{1}{2}$ funts per hour per square foot of grate surface.

b. For coal sold as Cardiff.—38 tons or 92,720 Russian funts = 3·3 funts per indicated horse-power per hour, and 24·43 funts per square foot of grate surface per hour.

c. For the cheap briquettes, 42 tons or 102,480 Russian funts = 3·68 funts per indicated horse-power per hour, and 27 funts per square foot of grate surface per hour.

N.B.—The French ton = 1,000 kilogrammes = 61 puds. Using the coal like Cardiff, and also the cheap briquettes, it is very difficult with seven boilers to get sixty-eight revolutions out of the engines, and so, in order to ease the work of the stokers, the 8th boiler was used after three or four days' steaming.

Fire Grates.—Experience showed that Belleville's patent iron corrugated grates are not practical, because they frequently bend and they require considerable time to put them right. Accordingly, on the "Ortegal" they now use ordinary cast-iron bars, of which they keep a considerable reserve always.

Special Valves for the Passage of Steam from the Boilers into the Steam Exhaust Pipe.—The safety valves of the boilers of the "Ortegal" have no appliances for opening them at will, and, accordingly, on the forward ends of the steam conducting pipes, which run along each stokehole, there are valves, by means of which the steam can be driven through the steam exhaust pipe.

Special Valves for Passing the Water from the Boilers into the Hold.—The Belleville boilers, while not working, are kept filled with water, and in order to lower the water to the working level or to empty the boilers, there are valves on the forward ends of the blowing off pipes, which are situated in the hold. The water is passed into the hold through these pipes.

Fresh Water Tanks.—On board the "Ortegal," near each Belleville donkey engine, there are two fresh water tanks. The capacity of each of these tanks is 1½ tons. These tanks communicate with one another as well as with the reserve fresh water tank, which holds 4 tons, and which is supplied with water from the condensing apparatus or from overboard when the vessel is lying in a river.

N.B.—Near each Belleville donkey two of the fresh water tanks which communicate together are made so that each of the tanks can be placed between two ribs of the vessel, and thus a considerable portion of the tank can be accommodated in the hull below the engine-room floor.

Special Donkey for Pumping the Fresh Water out of the Condenser.—While the vessel is at anchor the steam is passed into the condenser. The waste steam from the auxiliary engines can also be passed into the condenser, accordingly there is a special donkey for pumping the water out of the condenser into the fresh water tank, while the vessel's engines are not working.

Spare Parts of the Boilers and their Appliances.—On the "Ortegal" there are spare sections for two boilers, and boiler appliances as well; in addition to this there are several spare boiler tubes with their uniting boxes. Generally, on board the "Ortegal," there is a reserve supply of 25 per cent. of all boiler fittings, not excluding the movable parts of the Belleville donkeys.

Time necessary to get up Steam.—Although it is possible to get up steam in the Belleville boilers in half an hour, recourse was never had to such rapidity, but steam was ordinarily got up in two hours.

Time required for Emptying the Boilers and Filling them again.—Although M. Belleville proposes to blow off his boilers immediately the fire has been raked out of the furnaces, and to refill them immediately with water, recourse was never had on board the "Ortegal" to such operations, and usually, in case of changing the water in the boilers, it was allowed to cool, and then passed into the hold.

N.B.—The engineers of the "Ortegal" find that when steam is got up rapidly and when the water is renewed in the boilers rapidly, the bending of the tubes, which occurs at present, would be much more considerable, and probably a leak would occur in the joints of the tubes.

Testing by Sounding the Interior Surfaces of the Tubes of one of the Boilers of the "Ortegal" during its fifth year of Service.—On the return of the vessel

to Bordeaux I tested by sounding the interior surfaces of the tubes of the starboard bow boiler, and found that in the five upper rows of tubes there were fifteen tubes, in the walls of which erosion had commenced. In the four lower rows of tubes, however, no erosion of the walls was discovered. As the boiler was selected at haphazard, and as all the boilers had been subjected to the same conditions during their four years' service, we may suppose that in all the boilers there was similar erosion of the tubes ; but of this I was unable to convince myself, because it was proposed to clean the boilers by turns during the two months the vessel lay at Bordeaux for repairs to her engines.

Notes as the Service of the Boilers of the s.s. "Sindh" of the Messageries Maritimes.

On the 15th of June I inspected at Marseilles the boilers of this steamer, and I collected the following details regarding the service of her boilers. I got these details from the chief engineer of the vessel, who was instructed to afford me every information, which he did most willingly, placing, moreover, the ship's records at my disposal :—

1. There are twelve Belleville boilers on the vessel. The engines are compound and the steam comes into the engines at a pressure of 6 atmospheres.

2. The boilers have entered their third year of service, reckoning from the day when steam was first got up.

3. During the two years' service of the boilers they were under steam 400 days, of which fifty days were getting up or keeping up steam.

4. The steamer makes voyages with an average speed of 13½ knots. To attain this speed the engines should develop 1,800 to 2,000 indicated horse-power, with a daily expenditure of coal (Cardiff) from 50 to 55 tons. The steamer usually runs with eleven boilers.

5. The boilers of the steamer are always fed with fresh water, obtained by means of a condenser, provided with a boiler and condensing apparatus. The quantity of fresh water required to fill the twenty-four hours' waste of water in the boilers is not more than 5 tons. On the "Sindh," as on the "Ortegal," not a drop of water is lost either in blowing off the boilers or in passing off the exhaust steam from the auxiliary engines.

6. The boilers are cleared of sediment after twenty-six days of steaming, and then the thickness of the deposit does not exceed 2 mm.

7. During runs of thirteen days the salinity of the water in the boilers is not permitted to exceed 2 degrees, which is easily attained by moderate blowing off.

8. The patent Belleville grates, as they get damaged, are replaced by ordinary cast-iron grates.

9. In all the boilers there are many tubes bent in the lower rows, especially in the third row, reckoning from below. The amount of curvature varies from 2 mm. to 28 mm. During two years' service twelve tubes in the lower rows were changed, owing to their becoming excessively bent, and also some of the uniting boxes had to be changed, as the threads were spoilt when the tubes were screwed out.

10. During the two years the tubes were in use there was no instance of a hole being formed in them, but when tested by sounding it was found that erosion had commenced in several tubes of the upper rows in all the boilers.

11. The smoke boxes and iron casings of the boilers were bent, as was the case on the "Ortegal."

12. The tube and furnace doors are bent, and do not shut closely.

13. The brick bridges work satisfactorily.

14. The condensers are frequently tested with hydraulic pressure, to see that the packings of the tubes are in proper order.

15. There were instances of stoppage at the knees in the tubes, where these had been bent at right angles, which served as a communication from the columns of the water-gauge apparatus with one of the tubes of the second row in each boiler, and the result of this stoppage was that the water-gauge glass showed a false level, while there was no water in the boiler, and the tubes were red-hot.

16. The automatic apparatus acts satisfactorily in every condition of the sea.

These replies of the Chief Engineer of the "Sindh" go to support the results of my observations on board the "Ortegal."

Notes regarding the Service of the Boilers on board the Cruizer "Milan."

I made a trip on this cruizer of 15 miles from the roadstead of Hyères to Toulon, lasting 1½ hours, and of course I was unable personally to convince myself as to how far the problem of feeding the two boilers of the cruizer with sea water had been satisfactorily solved. Accordingly I had to confine myself to questioning the Commander and the Chief Engineer, who were both in their second year of service on board the vessel. Their answers were as below :—

1. There are twelve Belleville boilers on the "Milan," and they have entered their fifth year of service, reckoning from the first getting up of steam.

2. Two boilers are devoted to keeping up the supply of fresh water in the boilers, and they are fed with sea water. For this purpose there are special feed pipes by means of which, and of one of the four donkeys, these two boilers are supplied with sea water. But after six days' steaming these two boilers have already on the sides of their tubes a deposit of 2 mm. thick, and consequently after every six days' steaming these boilers have to be cleaned, which is scarcely feasible in war time, and so the Commander of the vessel is asking that condensing apparatus may be fitted up to supply fresh water to replace the daily loss of water in the boilers.

3. The formation of the above-mentioned deposits 2 mm. thick in the course of six days' working of the boilers takes place in spite of the fact that the salinity of the water was never allowed to exceed 3½ degrees.

4. The number of days the "Milan" has been under steam does not exceed sixty, *i.e.*, three times less than the "Ortegal" and the "Sindh."

5. The "Milan" ordinarily steams at a moderate speed, and only runs three times during the year, and then each time only for three hours it makes runs with its greatest speed of 17 knots.

6. The tubes which were formerly on the "Milan" for the two lower rows in the boilers, 6 mm. thick, had bends in them amounting to as much as 26 mm., and they were changed a year ago for tubes 10 mm. in thickness ; in these new tubes the bends are as yet insignificant.

7. After three years' service of the boilers, holes were formed in the fifty tubes of the upper, and erosion was observed in 200 tubes. Accordingly a year ago these 250 tubes were replaced by new ones. A recent testing of the tubes by sounding did not discover new erosions.

8. The patent Belleville grates were replaced by ordinary cast-iron grates as they became damaged.

9. The automatic boiler fittings act satisfactorily.

10. The iron casings of the boilers, the smoke-boxes, the tube, and furnace doors warp.

11. The boilers are filled with fresh water at every convenient opportunity.

The boilers of the s.s. "L'Australien," the third vessel of the Messageries Maritimes fitted with Belleville boilers. The s.s. "L'Australien" was launched in May, 1889; she was built at the company's works at La Ciotat, between Marseilles and Toulon, and she has a displacement of 8,400 tons. Her engines were built at the same works, and should develop 7,000 indicated horse-power, and give a speed of 18 knots.

For these triple expansion engines there are twenty Belleville boilers, which are slightly different from those on the "Ortegal" and "Sindh."

1. In each of the boilers there are also eight sections, but in each of the sections there are eleven rows of tubes instead of nine rows, as in the "Sindh" and "Ortegal."

2. The limit of pressure of steam in the boilers is 16 atmospheres, and the steam is admitted to the engines with a pressure of 12 atmospheres; while on the foregoing vessels the limit of pressure is 12 atmospheres, and the steam reaches the engines with a pressure of 6 atmospheres. The diameter of the tubes is 125 mm. instead of 100 mm.

3. On board the "Ortegal" and "Sindh" there are double plates for the two lower rows of tubes.

4. The thickness of the nine upper rows of tubes is 6 mm. in place of 5 mm. The two lower rows, however, are 10 mm. thick, as on the "Ortegal" and "Sindh."

5. The separator has an inner partition of different construction, and, on account of the construction of this partition, the aperture for draining the reservoir is twice the size of that on the "Ortegal" and "Sindh."

6. In place of the patent Belleville grates ordinary cast-iron ones are used.

7. The external iron casings of the boilers and the smoke-boxes are so made as to expand, and not bend in as on the "Ortegal" and "Sindh."

8. The funnel is 22 m. high, reckoning from the grates, and is provided with a casing which runs the whole length of the pipe, and which is at 355 mm. from it.

9. The doors of the tube chambers are in four parts, instead of two, as on board the "Ortegal," where the doors warp and do not shut closely. These doors are of three sheets of iron, viz., the first, or inner, sheet is of corrugated iron, then there are two parallel iron plates. The interstices between the above sheets are filled, the first with asbestos, and the second with cork. In addition to this, parallel to the last sheet, and at 15 mm. from it, there is a sheet of gun metal which serves to reflect the heat. There is asbestos packing in the grooves of the frames of the doors, to enable them to be closed tightly.

10. The furnace doors on the "Ortegal" are of three parallel sheets, of which the first, or innermost, is of cast iron, and the other two of wrought iron; nevertheless, the inner sheet often burns and the doors warp. To avoid these defects on board the "Australien," the inner plate is made of corrugated cast iron, and is fastened to the iron plates by means of a single bolt, so that the inner plate can be readily replaced in case it is burnt. In order that the doors may shut closely, their edges are carefully fitted to the door frames.

11. The ashpits can be easily taken out of their recesses, and so the portion of the bottom plating under them can be frequently cleaned and painted.

Table showing the principal Details of the Belleville Boilers on the Messageries Maritimes Steamers.

	"Ortegal."	"Sindh."	"Australien."
Number of boilers	8	12	20
Grate surface	243 sq. ft.	295 sq. ft.	596 sq. ft.
Heating surface	7,414 "	11,050 "	23,059 "
Ratio of heating to grate surface	30·50	37·46	38·7
Weight of water in the boilers when filled to working level	7·4 tons	9·6 tons	20 tons
Weight of boilers and appliances	130 "	190 "	280 "
Number of H.P.	2,100	2,400	7,000

From this table it results that per indicated horse-power :—

a. The grate surface varies from ·095 to ·12 square feet.

b. The area of the grate in the boiler does not exceed 30 square feet, and the length of the furnace (fore and aft) is not more than 6 feet, and its width (athwart ships) not more than 5 feet.

c. The weight of the boilers with water and appliances varies from ·043 to ·083 tons.

Upon the basis of these data deduced from the foregoing table, we will attempt to determine the question, whether there is any gain in the space occupied by the boilers, and in their weight, if the ordinary boilers are replaced by Belleville boilers on a cruizer, the engines of which can develop 12,250 indicated horse-power with natural draught.

For such a cruizer we should propose eight double cylindrical boilers, 15½ feet in diameter, 17 feet long, with a grate area of 1,152 square feet (·092 square feet per indicated horse-power), and with a heating surface of 34,000 square feet. The weight of these boilers with water and appliances would be 970 tons. The space occupied by these boilers with their stokeholds would be, fore and aft, 124 feet, and athwartships 37 feet 8 inches, *i.e.*, 18 feet 10 inches right and left of the central bulkhead. If sixteen ordinary cylindrical boilers were used, their weight with water and appliances would be 1,053 tons, reckoning ·083 tons per indicated horse-power.

Let us see how many Belleville boilers would be required to replace the above double cylindrical boilers, and of what dimensions they ought to be.

Taking for the Belleville boilers, from the above table, ·1 square feet of grate per indicated horse-power, the grate surface for all the Belleville boilers must have an area of 1,225 square feet. Taking the total area at this figure, it is easy to fix the number of Belleville boilers.

In fixing the dimensions of each boiler, we naturally keep to the dimensions of the boilers of the above-named vessels of the Messageries Maritimes, since their boilers had been found satisfactory in practice.

From the above table, it appears that the grate area of each boiler does not exceed 30 square feet (viz., 6 feet wide and 5 feet long), and the external dimensions of the boiler are, length, 8 feet ; width, 6½ feet, and, taking these as the dimensions for the boilers of the cruizer, the number of them should be 40.

If these boilers are to be disposed as they are arranged on the Messageries vessels, *i.e.*, back to back, furnaces outboard, this arrangement will be most advantageous both for ventilation of the boiler rooms, and also for the manage-

ment of the boilers in all respects, as well as for the arrangement of the donkeys, ventilators, openings to the coal bunkers. If the boilers are so arranged, it may be asserted with certainty that the temperature of the stokeholes, even in the tropics, will not exceed 41° C. But, unfortunately, with the above dimensions of forty boilers they will occupy 160 feet of the vessel's length, *i.e.*, 36 feet more than the double cylindrical boilers. Moreover, the length of the engine-rooms will have to be increased by 8 feet to allow for the separators and the *regulator-détendeurs* with the boxes for the safety valves—apparatus which are peculiar only to the Belleville boilers.

This increase by 44 feet of the space occupied by the boilers and machinery along the length of the vessel is compensated for partly by the increase in width of the coal bunkers on each broadside by 2 feet, and that for a length of 168 feet on each broadside. Thus the contents of the broadside coal bunkers is increased by 14,784 cubic feet. Taking 43 cubic feet per ton of coal, the coal supply is increased by 343 tons, or 18 per cent., as with the double cylindrical boilers, 1,917 tons can be placed in all the coal bunkers. Unfortunately the space occupied by the engines and boilers on the cruizer cannot be increased by 44 feet along the length of the vessel, and accordingly we must give up the idea of arranging the Belleville boilers in the manner which is most advantageous in all respects.

Let us see how much the space occupied by the Belleville boilers on the vessel must be increased if we retain the above dimensions, and arrange them so that the furnaces of the boilers should be turned towards the transverse watertight compartments. In this case, the space occupied by the Belleville boilers along the length of the vessel would be 150 feet, that is, even then, 26 feet more than that occupied by the double cylindrical boilers. Adding another 8 feet for the increased length of the engine-rooms, for the accommodation of the general steam purifiers and regulators, with the boxes for their safety valves, the total increase of space occupied by the engines along the length of the vessel with the Belleville boilers will, even with this arrangement, be 34 feet more. But the width of the broadside coal bunkers will then be increased by 1 foot for a total length of 158 feet on each broadside. Owing to this increase of width of the broadside coal bunkers, their contents will be increased by 6,952 cubic feet, and therefore the coal supply will be increased by 160 tons, and will be 8 per cent. more than with the double cylindrical boilers.

In spite of the increase of the contents of the coal bunkers when using Belleville boilers of dimensions identical with those of the boilers of the vessels of the Messageries Maritimes Company, there is no possibility of affording 34 feet more space for the engines of the cruizer than with the double cylindrical boilers, not to speak even of an increase of space of 44 feet, which would be required if the boilers were to be arranged in the most advantageous manner. Thus we have to give up the idea of arranging the boilers most advantageously on the cruizer, and also of retaining the dimensions of the Belleville boilers which exist on the vessels of the Messageries Maritimes Company.

Let us see what ought to be the dimensions of the Belleville boilers so that the space occupied by these boilers along the length of the cruizer should not be more than the space occupied by the cylindrical boilers, *i.e.*, not more than 124 feet. For this purpose we would need to use boilers the external dimensions of which will be: length, 8 feet 8 inches, and width, 7 feet 8 inches, and the grate surface of each boiler 43·60 square feet. The length of the grate will be 6 feet 1 inch, and the width 7 feet 2 inches. Against a width of grate of 7 feet 2 inches no objections can be urged, but a length of grate of 6 feet 1 inch will be 20 per cent. more than the length of grate of the boilers of the vessels of the Messageries Maritimes Company, and therefore it will be much

harder for the stokers to keep up effective heat in the furnaces, which is especially required with Belleville boilers. Moreover, the increase of length of the grate surface will result in an increase of length of the boiler tubes of 20 per cent., which is most undesirable, because, with a length of tubes not exceeding 5 feet, the amount of curvature when the tubes become bent reaches $1\frac{1}{16}$ inches; but if the length of the tubes were increased to 6 feet 1 inch, the amount of their curvature would certainly increase, and probably more than proportionately to the increase of their length.

If such boilers are to be arranged in the most advantageous manner in all respects, that is to say, back to back, furnaces outboard, the boilers will occupy along the length of the vessel 124 feet, that is, the same as the ordinary boilers. But, unfortunately, the total length of the engine-rooms will have to be increased by 8 feet to allow for the separators and the regulators, with their boxes for the safety valves, and the compensation for this valuable sacrifice of 8 feet along the length of the vessel will be insignificant, viz., an increase of 1 foot in width to the broadside coal bunkers for a length of 132 feet on each broadside. This will increase the contents of the coal bunkers by 5,708 cubic feet, or the coal supply will be increased by 6 per cent., for with the cylindrical boilers 1,917 tons can be placed in the coal bunkers.

Let us see what advantage will be gained in point of economy of space if the boilers are arranged in a different manner, viz., placing their furnaces towards the transverse watertight compartments. If they are arranged in this manner, 114 feet will be wanted for the boilers along the length of the vessel, that is, 10 feet less than for the ordinary boilers; but this 10 feet will be occupied by the separatcrs and the regulators with their safety valves. This arrangement of the boilers will not involve an increase in length of the engine-rooms; but, on the other hand, there will be an increase to the width of the coal bunkers. This arrangement of the boilers cannot be recommended, for it will be very difficult to ventilate the stokeholes and to arrange for the tubes, donkeys, &c.

N.B.—I do not put forward a further arrangement of the Belleville boilers, viz., furnace to furnace, because such an arrangement, although it would lead to a saving of space along the length of the vessel of 4 feet, is quite inadmissible for Belleville boilers, because if they are thus arranged the heat will be unbearable, and the stokers will be unable to work. This arrangement may be admissible for ordinary boilers, but it is absolutely inadmissible with the Belleville boilers, because with the latter the walls and doors heat much more than with the ordinary boilers.

From what has been said before, it is clear that there can be no saving in space along the length of the cruizer if cylindrical boilers are replaced by Belleville boilers, even using those boilers of increased dimensions as compared with the dimensions of such boilers on the vessels of the Messageries Maritimes Company. The increase of the dimensions of the boilers, and the increase of length of the fire grate and of the boiler tubes by 20 per cent. which is involved thereby, is undesirable, both as regards the care of the boilers and also as regards the bending of the tubes.

It thus appears that as regards the space occupied by the Belleville boilers compared with that occupied by the ordinary boilers in the cruizer that we are considering:—

1. That, with the arrangement of the Belleville boilers which we should most wish for, and with boilers of increased dimensions, not only will there be no saving of space along the length of the cruizer, but, on the contrary. the engine-rooms will have to be lengthened by 8 feet to provide for the appliances which are peculiar only to Belleville boilers. The increase of contents of the broadside coal bunkers, due to the increase of their width, will augment the coal supply only 6 per cent.

2. Arranging the boilers in the way which is only a tolerable way, viz., furnaces towards the transverse water-tight compartments, the space occupied by the boilers will be decreased by 10 feet along the length of the vessel, but this 10 feet will be taken up by the apparatus which are peculiar only to the Belleville boilers.

And so, finally, the space occupied by the Belleville boilers will not be in any case less than the space occupied by the ordinary boilers. This conclusion is borne out by the project which has been put forward for Belleville boilers for the ironclad "George the Victorious,"[1] where the Belleville boilers with their appliances occupied 4 feet more along the length of the vessel than the ordinary boilers, viz., 108 feet, instead of 104 feet or 4 per cent. more, and that too with a grate surface per indicated horse-power of only ·096 square feet.

Saving in Weight by Replacing Ordinary Boilers with Belleville Boilers.

The weight of the double cylindrical boilers of the cruizer with the water in them and their appliances will be 970 tons or ·079 tons per indicated horse-power. The weight of the Belleville boilers with water and appliances, and also with spare parts for the boilers and their appliances, will be 612 tons, reckoning ·050 tons per indicated horse-power, and so the saving in weight in favour of the Belleville boilers will be 355 tons, or about 36 per cent. Using sixteen ordinary cylindrical boilers, their weight with water and appliances will be 1,053 tons, reckoning ·086 tons per indicated horse-power. By replacing these boilers by Belleville boilers there will be a gain in weight of 42 per cent.

Cost of Belleville Boilers.

According to the statement of the Assistant Manager of the workshops of the Messageries Maritimes Company, the cost of the Belleville boilers to the Company is 10 per cent. more than the cost of ordinary cylindrical boilers for the same indicated horse-power.

Conclusions.

From what has been said before, we may deduce the following conclusions :—

1. The Belleville boilers with their appliances cannot, in any case, occupy less space along the vessel than the ordinary cylindrical boilers; on the contrary, the Belleville boilers with their appliances, if arranged in the most advantageous manner, will occupy about 6 per cent. more than ordinary boilers along the line of the vessel.

2. If Belleville boilers are used, the saving of space along the width of the vessel will enable the coal supply in the bunkers to be increased by not more than 10 per cent., and this increased supply will be only apparent, for Belleville boilers expend 10 per cent. more coal than ordinary boilers per indicated horse-power.

3. The weight of the Belleville boilers with water appliances and spare parts will be from 36 to 42 per cent. less than the weight of cylindrical boilers for larger vessels.

4. The working and management of Belleville boilers present no difficulties even with voyages of thirty days' uninterrupted steaming.

5. All the automatic appliances of the Belleville boilers act thoroughly

[1] The "Georgiy Pobédonosets," now building at Sevastopol.—J. W. M.

satisfactorily, independently of the condition of the sea; but the Belleville donkeys need some slight alterations to prevent the formation of a galvanic current in their pumps. The pumps should be made of bronze instead of cast iron with bronze linings.

6. The quantity of distilled water required for making good the inevitable waste of water in the boilers does not exceed 3 tons in the twenty-four hours for each thousand indicated horse-power, even on voyages of thirty days' uninterrupted steaming.

7. The Belleville boilers should not be fed with sea water except in case of the most urgent necessity, which could only happen under most exceptional circumstances.

8. If fed with distilled water, the Belleville boilers do not require to be cleaned until after thirty days' steaming; but if they are fed with salt water, the tubes will inevitably burn through, even after eight days' steaming, as is conclusively shown by the trips of the steamer "Ortegal" from Marseilles to London and back.

9. The expenditure of coal per indicated horse-power, with precisely similar engines working under precisely similar conditions, is 10 per cent. more with the Belleville boilers than with ordinary boilers.

10. In the Belleville boilers there is a rapid formation of deposit in getting up steam, for the Belleville boilers necessitate the effective combustion of the fuel in their furnaces. While steam is being got up, that is, while the combustion is slow, there is a rapid formation of deposit in the tubes—a fact which M. Belleville himself does not deny, and which forms one of the disadvantages of the Belleville boilers, especially for vessels which are required to get up steam frequently, such as torpedo-boats and steam-launches; and accordingly Belleville's boilers cannot be recommended for these vessels. Moreover, for small vessels, the weight of the Belleville boilers is more than the weight of ordinary boilers for the same indicated horse-power.

11. The patent Belleville grates did not appear suitable, and accordingly they were replaced by ordinary grates, both on the vessels of the Messageries Maritimes Company and on the cruizer "Milan."

12. Belleville boilers, if vessels are sent on a three or four years' cruize, should be supplied with spare parts, tubes, and uniting boxes, and also with spare boiler appliances and their parts, including the working parts of donkeys, to about 12 per cent.

13. The four years' service of the Belleville boilers on the steamer "Ortegal," and also the circumstances of the two years' service of the boilers of the steamer "Sindh," point to the conclusion that the Belleville boilers, when they are fed with fresh water, and when measures are taken to keep the condensers in proper order, and also for preventing the loss of fresh water, may serve without repair for the first four years. But after four years' service of the boilers, the tubes, which form the boilers, must be changed gradually. This changing of the tubes should be no hindrance to continuing the service of the boilers without a stoppage, for the changing of the tubes would take place gradually in the course of two years. By the end of the sixth year of service of the boilers, all the tubes should have been gradually replaced both on account of the erosion of the tubes, which was clearly shown in the boilers of the vessels above mentioned, and also on account of the bending of the tubes of the lower rows. The bending of the tubes of the lower rows took place in the boilers of all the above-named vessels, and the explanations of M. Belleville, both as regards the damage to the tubes by erosion and by their bending, are inconsistent; because he ascribes these both to the fact that the instructions, regarding the boilers being kept filled with water during the time they are working, were not observed, and also to careless management of the boilers during the time

they were at work, which it is obviously impossible to admit, as the bending and erosion of the tubes took place in the boilers of all three vessels. Moreover, M. Belleville himself, as regards the damage to the tubes on the "Milan," officially declared, in his explanation to the French Minister of War, that the boilers of the "Ortegal" were continually kept filled with water while they were being worked; and, as a matter of fact, was actually carried out during my ninety-nine days' service on that steamer. Yet in spite of this, in the fifth year of service of the boilers of this steamer, holes were found in one of these tubes, and erosions were observed in the sides of fifteen tubes in one boiler, which I tested by sounding.

14. Replacing unserviceable tubes by spare ones can be easily carried out, and the boilers, with tubes replaced gradually during the course of the five or six years' service of the boiler, can serve for another four to six years, but at the expiration of ten or twelve years' service, the remaining portions of the boilers, viz., separators, the external casings of the boilers, the smoke-boxes, funnels, and other parts will become unserviceable, and new boilers with all their appliances will have to be put in.

15. In the course of ten to twelve years' service of Belleville boilers the cost of their repairs will be about 50 per cent. of their original cost, and when repairs are going on, the deck will not have to be broken up.

16. In the course of ten to twelve years' service of Belleville boilers, the steam pressure in them will not have to be decreased.

17. Belleville boilers contain ten times less water than ordinary boilers of the same indicated horse-power, and accordingly the danger in case of the explosion of a Belleville boiler will be less than with an explosion of an ordinary boiler. If a Belleville boiler bursts, there is no reason to fear the loss of the vessel.

18. Taking into consideration the unsatisfactory service of the ordinary ship's cylindrical boilers with pressures greater than six atmospheres, as is shown by the experience of the large French Steamship Companies, where the service of such boilers does not exceed three to four years, we may conclude that Belleville boilers can successfully replace ordinary cylindrical boilers, commencing with pressures of six atmospheres, for vessels of not less than 2,000 tons displacement.

19. For pressures less than six atmospheres, Belleville boilers cannot be recommended, for with these pressures ordinary boilers serve successfully from eight to ten years, and are cheaper than Belleville boilers, both originally and for purposes of repair.

20. The use of Belleville boilers as auxiliary boilers on board ship presents no advantage, compared with boilers of the locomotive type. In both cases, for the preservation of the boilers, they should not be fed with sea water nor used for the condensation of water, except with apparatus properly filled.

21. In case Belleville boilers should be adopted for the vessels of our fleet, the factory which takes upon itself the construction of Belleville boilers should be constantly on the look-out, for such improvements may be introduced, owing to the experience gained in the construction of new Belleville boilers for their vessels, by the Messageries Maritimes Company, who are constantly and energetically removing the disadvantages or defects which are observed in the boilers. Thus, for instance, in the steamship "Australien," the defects in the boilers (and particularly in their appliances) which have been discovered in the working of the boilers of the steamships "Ortegal" and "Sindh" are being removed. The Messageries Maritimes Company, generally speaking, is conducting the business of utilizing the Belleville boilers in an intelligent manner.

22. In the construction of Belleville boilers it is necessary to be most exacting as to the quality of the material employed, and also as regards the

perfection of manufacture of each detail of the boilers and their appliances; because it is only by the accurate observance of these conditions that the boilers can do their work successfully.

N.B.—During the four years' service of the boilers on the above-mentioned vessels, the uniting plates of forged iron were not damaged, with the exception of some cases in which these plates had to be changed owing to the screw threads in them being damaged, when the tubes which had become unserviceable had to be screwed out of them, and so there is no reason for placing any limit of service upon these plates. One plate which I inspected, when a burned tube had to be removed, appeared to be in a satisfactory condition, as the wall of the plate had only been diminished 1 mm. after four years' service.

CRUIZER-WAR AND COAST DEFENCE.

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By Commander H. GARBETT, R.N.

FIELD-MARSHAL MOLTKE very rightly lays down in the volume issued by the General Staff on the Franco-German War, that no plan of operations can reach with any certainty beyond the first encounter with the enemy's main force, and that only uninitiated civilians believe they can see in the progress of a campaign the prearranged execution of an original plan, all the details of which have been previously settled and carried out to the end. But he accentuates also that faults, which have been made in the design of the first operations, are not often repeated in the later phases of a campaign. It follows, consequently, that a special weight must be attached to the preparation for war, and that the more thorough and effectual this preparations is, the more favourable stand the chances which can be counted upon to ensure success. Exertions are therefore now being made in all countries with the object of placing themselves in readiness in a time of peace for a state of war, not merely by the assimilating of the organization of forces, but also by the taking into consideration the different theatres of war, and the plans of operation in connection therewith, no less than by the most exact and systematic regulation of every factor which may complete and render available all real powers of offence. People of to-day are under the conviction that the one best supplied with natural intelligence, as well as with matériel, can reckon with equal strength upon a favourable result, and that which holds good for land-war is of no less importance in naval warfare. There is certainly to-day still wanting that broad theoretical basis, which is at the disposal of military men, and not less wanting, the rich supply of experience of the land forces. It cannot be denied that lately people have certainly busied themselves searching into the questions which relate to the art of naval war, and that efforts are being made to find a serviceable theory. Up to a short time ago, little attention had been bestowed upon this latter, and in practice, the influence of casual factors showed itself more than the observation of fixed scientifically grounded maxims and leading ideas. Men at sea had occupied themselves generally far more with tactical matters, and the greatest stress was really almost entirely laid upon the so-called seamanship. The development and education was purely a moral one, and it cannot be denied that in this direction it produced excellent results; but the military element remained on one side. Don't let us be misunderstood, we in no way comprehend the whole business of "gaiters, &c., and a stiffness depending principally on externals," but we understand under that head the uninterrupted aim of activity and attention to the training for the solution of military duties, in connection with a clear comprehension of the aims and forms of the practical carrying on of war. It is true that the naval service develops for itself characteristic qualities, which are of the highest importance for war, and that an expert seaman in his own *métier* already attains soldierly qualities, which in the first place have to be imparted to a land soldier, and for the presence of which in him one, however, possesses no guarantee, because they cannot be proved before the necessity for them actually arrives. But while these virtues suffice for the lower materials,

leaders of the different grades require yet something more, it is what we might specifically term the *military element*, which makes out of expert seamen just as expert and thoughtful soldiers.

Certain it is that the navies in the second half of our century have reached a stage of development abounding in difficulties. The whole nature of fleets has been changed, and we can well say that tradition is all that remains of earlier days. And there is another circumstance which must be considered conjointly with this. Since the Napoleonic wars, nations, with the one exception of England, who in consequence of her success during these wars was highly content with her system, have not attached any great importance to navies, and have maintained fleets more from old custom than any inward conviction of their importance. There was almost no inducement for anyone to take up with this department as a whole.

Certainly, during that long epoch of peace the theory of war on land has great progress to record. General von Clausewitz wrote a celebrated work "On War," in which this clever reasoner laid down clearly the broad features of the vast mass of experience, which had been so thoroughly mastered by him, and which will be for all time a standard for the due comprehension of war, and for the most effectual way of carrying it on. What Clausewitz theoretically laid down has since in no points been shaken, but his genial successor, Field-Marshal Moltke, has in particular furnished the practical examples of his precepts, and has taken such special pains, that the art of war is now matured into a sure system, from which one cannot deviate without harm, but which again cannot be manipulated as a formal piece of mechanism, but requires brains and a clear mind, besides a bold and strong will. The lessons of Clausewitz remain good in spite of the changes in weapons, and they are not touched in their essentials by the development of the means of communication. As regards naval war, on the contrary, we cannot point to a similar work, and partly, although not fundamentally, because we have not at our disposal a similar quantity of experiences of every kind, but, on the other hand, find ourselves suddenly transplanted into a period of innovations rapidly following each other, in which the most complete attention has been devoted, but to only one side of the question. Types and questions of weapons ruled the situation, and the Navy was obliged to model and put together anew its whole armour. It hit entirely by chance upon the field of technics, and technical points of view asserted themselves as the leading ones. It might well have been better if in this epoch of novelties the art of naval warfare had been able to trace out the paths of technics, upon which it could have turned its new knowledge and power to good account. We should then have fallen less upon the difficult field of experiment, and should have aimed systematically and with fewer intermediate stages at the remodelling of the matériel and weapons of offence. Technics, as such, have seldom exhibited performances so brilliant and progress so rapid as in naval matters; but opposed to this indisputable fact stands the circumstance that the technologist proceeded and presupposed very much according to his own judgment, and that the seaman has to adapt everything which comes from the head of the constructor.

We find to-day a very striking contrast between the land and sea forces. On the one hand efforts are made to attain as great simplicity and conformity to principle as possible, and we sacrifice to this principle many traditions of historical value, many a well-loved regulation and many a custom worthy of honour. We have to-day only one kind of infantry, all armed and trained alike, we strive after a uniform method of using the cavalry to the best advantage, and we provide our field-artillery with guns mostly of only one calibre. And just as there is now an absence of the many different kinds of weapons which were found in

days gone by, so also is special weight laid upon the uniformity of the larger arrangements for the combination of the separate bodies of the Army. For this purpose we find an almost identical normal scheme in the large military States of Europe. This tendency to uniformity facilitates in a high degree the management of the forces, and it removes from the leader the troublesome necessity of being obliged to be continually considering the capabilities of the several component parts of his force.

How completely different on the other hand does the case stand with modern fleets! There every description of variety is almost the rule, and here is the question. One would think, that certainly at sea where movements are made under conditions so similar, uniformity would be of particular value. Were it possible that all the ships which are detailed for the performance of the same duties should be of the same capacity, the task of the Admiral would be sensibly lightened, and he would not in time of war find himself in situations which have already proved extremely awkward in the manœuvres that have taken place during the last few years. We see there two things repeatedly made clear; the movements of a whole squadron must be regulated by the speed of the slowest ships, or an action requiring unity of movement cannot be properly brought to an issue on account of the great difference of speed between individual ships, and through that defect has been lost.

Speed is of the first importance, but it does not stand alone; the fighting value in other respects must be taken into consideration. But to this very day it is difficult to fix standard types adapted to all cases, and in view of these standard types we can only gradually strive to obtain a formation of the fleet approaching uniformity, One would imagine that the first question is to be quite clear as to the different classes of ships which a naval force requires, having due regard to the requirements of war, and then to find the standard-type for each of these classes.

But the sure solution of such a problem demands above everything clearness on two points, namely, on what is required for the purposes of war, and as to the real value of what the ship-constructor and gun-maker offer.

In theory we can only approach the desired object up to a certain point, practice, however, is the only real test. But although we cannot obtain all that we want, yet nothing should be neglected which appears feasible. The thorough and earnest pursuit of the art of naval warfare in its wider ranges will in any case be advantageous and essentially conduce to the solution of many points. To this end these great manœuvres especially lend themselves the importance of which we cannot over-estimate and must in no way underrate. That such manœuvres are already necessary in order to afford Officers and men opportunities for practice in the handling of modern ships goes without saying. Less agreement prevails over the question whether such manœuvres can serve as real tests for war. This is a difficult point, but if a rational form is given to the manœuvres and an earnest attempt prevails to adapt to the conditions of war the presumptions and the whole circumstances, so far as it is possible to do so, and to dispense with everything which is limited by hard and fast rules, then we shall constantly be able to draw a picture which will serve as a basis on which to sketch the form of the reality. To be on the safe side it is best to look at things from the worst point of view. However, we must not draw conclusions from the results of one single set of manœuvres, but as far as practicable, we must take into consideration everything which may suggest itself to us, or about which we may be in possession of more exact information.

If we consider, for example, the great manœuvres of the British Fleet, which have taken place in the years 1888 and 1889, we obtain from them a quantity of most valuable suggestions although there may be much which was

faulty in their conception. The manœuvres of the past year have emphasized one fact, which appears to us very worthy of notice and affords proper occasion for the discussion of several questions which touch in a wide sense the foundation of the art of naval war.

Cruizer-war formed part of the plan of operations and numerous prizes were captured; and though the strategical results proved favourable to those on whom lay the defence of England, yet the enemy, whose base Ireland was considered to be, recorded considerable successes in the capture of prizes, and his cruizers in spite of all his opponents' efforts to protect his trade were seldom met by the hostile war ships and were not at all disturbed in their activity. The result showed that it is difficult to check the operations of a cleverly commanded fast trade-destroying cruizer.

We may take this opportunity of making another observation in reference to the attacks directed against the hostile coasts and to the question, how they can be prevented. From the examples on this point during the manœuvres of 1888 and 1889, one recognizes clearly a tendency in the British Navy towards a widespread destruction of hostile property, without any distinction as to whether it is public or private. Raids against hostile coasts with destruction of ships and dockyards and the laying of cities under contribution played both times a great part in the operations. We find in this the confirmation of a view repeatedly put forward by us, that we must familiarize ourselves with the idea, in a future naval war, of seeing the attacks against private property carried on with all energy—at least unless there is a great change of opinion on all sides—and that even those who on principle are disinclined to the measure will nevertheless be compelled on their side to adopt it. The chase after the enemy's private property is the business of cruizer-warfare. And as this property moves both under the merchant flag at sea, as well as lying warehoused on the coast, so there is an intimate connection between this warfare on the one hand and coast defence on the other. Both must be taken into consideration in preparing for a naval war. This preparation corresponds to that series of measures which are comprehended in the so-called mobilization scheme of an army, and certain it is that that side wins immediately an enormous advantage at sea, which is in a position to make the first attack, particularly if it is fortunate enough to interfere materially by its action with the mobilization arrangements of the enemy. We must not forget that losses which are suffered in the matériel of a fleet can very often not be replaced during a campaign, and further, that any advantages gained immediately on the outbreak of hostilities will exercise for some time a considerable moral effect. It is therefore absolutely necessary that there should be no uncertainty about the operations which it is intended to carry out at sea in the event of war, and that the naval forces should be held in such a state of readiness, that these operations can be entered upon at once without any loss of time. The question, however, is not merely as to the immediate readiness for war of the matériel, the possibility of the rapid fitting out of the ships in reserve, the calling in of the men to complete the crews, the appointment of the Commanders and Officers who have already been detailed, and the rapid setting in motion of the means of defence, &c., but also to an increasing watchfulness upon all the movements on the side of the enemy. It is necessary to be acquainted each moment with the conditions, distribution, and movements of his fleets, and to calculate carefully all the plans which are open to him, and determine our own conduct accordingly; but the more carefully we ponder everything, so much the more sure shall we feel in our own preparations and so much the less be exposed to unexpected surprises.

The readiness to strike a blow rapidly offers yet another advantage; it guarantees the possibility of being able to take the "offensive;" and the

maxim often verified by facts remains true under all circumstances, that to take the "offensive" is of the highest importance, and from this the rule may be deduced, that, even when obliged in view of the whole situation of the war to remain on the "defensive," yet, the taking of the offensive when opportunity offers should not be renounced, as the plans of the enemy may be thereby thwarted, and his well planned combination disordered. Naval war which permits of such exceedingly free movements, and in which many factors which have to be considered in war on land are absent, is particularly favourable for offensive movements, and it would therefore be a grave fault to throw away this advantage, if circumstances permitted an approach to the enemy. Naturally the general principle must be adapted to circumstances, and the whole naval scheme of operations be brought into harmony with the general plan of the war. It must always be kept in view that the fleet is a portion of the main forces, and that the aims which they pursue, and which must be covered by the political purpose of the war, form a complete whole. In the outline of the general plan, account must be taken whether a war with squadrons on a large scale in addition to cruizer-warfare is to be carried out, or substantially the latter alone; whether and in what manner the coasts are to be protected; and finally how far a close co-operation with the land forces is requisite for this.

Cruizer-warfare to be successful requires a good deal of preparation. The first question is, what is the aim of this sort of warfare? The common answer is, the threatening and damaging the enemy's commerce as much as possible. What is to be gained by that? The damage inflicted or threatened is a powerful weapon towards compelling an enemy to come to terms. It follows therefore that cruizer warfare pursues both a material and moral aim, first by the direct damage which it causes, secondly by the panic created in all circles which consider themselves exposed to this damage; and this second cause will frequently act far more effectively than the first. Cruizer-warfare can further be directed towards a two-fold object; against merchant ships under the enemy's flag, and against the hostile coasts, and in some quarters it is believed that this warfare may take the place of a coast-blockade. There has been a good deal of discussion lately about the value of coast-blockading, so we need not further enter into it here; it suffices to point out, that owing to the means of defence of the present day, which constitute a very active form of defence, a blockading fleet will find itself in a very difficult position, and in spite of the greatest activity and vigilance may fail in effecting their purpose, besides being continually exposed to the danger of suffering considerable losses, while the fact remains that owing to the largely increased means of intercourse of to-day, trade will be extensively carried on in an indirect way, even when the direct sea route is barred.

But there is another view of the case, if instead of a blockade, raids against different parts of the coast are undertaken. A considerable disturbance of commerce can be at least partially effected; and further, rapid raids can be made against special points, the effect of which will be felt along the whole coast; greater security and freedom is afforded to the assailant, while the defenders are placed in the difficult situation of not knowing exactly where to aim their counter-attacks. And here lies a great difference between this method of warfare and blockading, the blockader must keep the whole coast under observation, while the manner in which his force is disposed is also well known.

The threatening of a coast by raids affords, however, a further advantage over blockading; it needs a far smaller force, although the vessels must be adapted for cruizer warfare. All these facts point to the advantage of sending cruizers only, where a blockade is likely to be of no effect, or where battle with a blockaded squadron is on other grounds forbidden.

Having now in a general way pointed out the active work which devolves on cruizers, we will consider somewhat closer the method in which they ought to discharge their duties. The cruizer represents the offensive element *par excellence*, and the more indisputably and unreservedly it corresponds to this, its characteristic, the greater will be its success. This characteristic of the cruizer will be arrived at by the combination of two factors, viz., the suitability of the ship, and the skill and energy of the Commander; of these two the last-mentioned is perhaps the most important, and may often make up for what is wanting in the ship. Safety lies in unwearied indefatigableness, and if there is one duty more difficult to fulfil than another, it may well be, that of successfully chasing a skilfully handled and well found cruizer.

This lies in the nature of things. The cruizer has freedom of movement; if only the hypotheses, of which we shall speak later, are not wanting. But in chasing a cruizer all movements have to be directed against another mobile point. Let this fact be quite clear, for it is a proof of the truth of the proposition, that it is far more difficult to protect great trade routes than for an enemy to interrupt them; and thus in cruizer-warfare to stand completely on the defensive is a difficult task. A cruizer must possess great speed, a considerable coal-carrying capacity, and be capable of fighting. The faster a cruizer is, the more will it lie in the power of her Commander to determine whether he will fight or not, and her fighting qualities will be called into play all the less, while the cruizer is devoted to the chase after prizes.

It is not our intention here to go into technical details, it must suffice to say that two types of cruizers are necessary: light vessels to harry trade and heavy ones for attacking coasts. Cruizer warfare requires very thorough preparation, and when once begun, a very circumspect carrying out. It would be in the last degree an error to think that ships once despatched should be left to their own devices, and free to act entirely according to their own pleasure. Therein lies a danger of not realizing the wished-for effect so completely as is possible and necessary.

All preparations must be made during peace; and the normal condition of the enemy's trade must be carefully studied, so as to decide the best method of damaging it, and further to fix the radius which is to be assigned to each cruizer as its field of action. It must not be forgotten how much more than the old sailing ships the cruizers of the present day are dependent on a base for completing their stores, and their coal in particular.

Of course it would be preferable if cruizers could put into their own harbours for this purpose, although this has its drawbacks, as it entails a certain regularity of movement on the part of the cruizer, which makes her pursuit easier. It may, therefore, often be preferable to complete with stores and coals at sea, when neutral ports cannot be depended upon. Colliers, therefore, must meet the cruizers at prearranged rendezvous; and this necessitates a carefully prepared organization, which may not always be in working order, for colliers must be chartered, despatched, and rendezvous at the right time, and as sometimes the first two of these operations have to be performed under the protection of a neutral flag, it is necessary to make the preparation in good time. If a cruizer is placed in position to keep the sea for a long time, she becomes all the more dangerous, as a fog, not easily penetrable, protects her, and it may be difficult to get news of her whereabouts. The colliers would serve at the same time as a means of conveying and receiving information. Apart from this means of communication, the cruizer would continually be obliged to proceed to certain fixed points in order to remain in touch with Headquarters. Under any circumstances, it is not advisable to retain a cruizer for long in one sphere of operations, as by shifting her the difficulty of pursuit is increased.

The plan of campaign must necessarily be regulated by the number of cruizers at disposal; but there are other considerations to be taken into account. The probable attitude of the enemy must be weighed, and the forces which he will be able to devote both to the protection of his own and the attacking of his opponent's trade. This entails an accurate knowledge of the enemy's Navy, and its readiness for action at a given moment; for the more extended is the field of operations—and in a war between great maritime Powers we might say that this field will cover nearly the whole waters of the globe—so much the more must it be remembered that the Power which at the outbreak of hostilities can act with the greatest energy has a great advantage, not the least of which may be his being able to prevent the other's cruizers from leaving port. The ideal of preparation lies, therefore, in the being able to despatch immediately cruizers to the most important spheres of action, and, further, in knowing how far the enemy is ready to act in the same direction. This ideal may be partly attained by an extensive system of stations in peace time, and by the power of using merchant steamers which habitually travel fixed routes as auxiliary cruizers; and this again necessitates the keeping of a continual watch upon them, so that at the moment of need their actual condition as well as their whereabouts may be known, in order that the final strokes may be given to the plans and dispositions accordingly.

We see from these suggestions that the measures which must be taken are many, and that the most difficult ones are those which have to be taken abroad. It will be necessary to have trustworthy agents with exact instructions at the places chosen as depôts or points of communication, who must be in continual touch with the authorities at home, and who can provide the necessary matériel required. No universal rules can be laid down for the guidance of these agents; they must be governed by circumstances.

Not less difficult are the duties which appertain to the supreme command during war. We must guard ourselves here against the mistaken view, first of all, that the cruizers should be entirely controlled by the authorities at home. We are much more convinced that a wide latitude should be allowed to the commanders, and that their hands should in no way be fettered, although, in the interests of their own preservation, they should keep touch with their supports and communications, as it cannot be denied, on the other hand, that there are disadvantages in a cruizer being completely isolated. The modern art of war lies in bringing every single force into communication with each other, and in that respect it enjoys an incalculable advantage over earlier times, due in a great measure to the rapid means of communication. The authorities at home must be unremitting in collecting all materials, a knowledge of which is important, for the cruizers, in particular, of the movements of those merchant ships of the enemy a pursuit of which is likely to be successful, and, above all, of the movements of the hostile cruizers towards the cruizing ground. Further, they must be prepared to modify the original spheres of action of the cruizers as the necessity occurs, or transfer them to other fields of activity. All this entails a well-considered and well-organized Intelligence Department, which cannot be called suddenly into existence in the hour of need.

A difficult point, finally, is that which concerns the disposing of prizes, for the more captures that are made, the more difficult becomes the position of the captor, if he is not within easy reach of some depôt under his own flag, for he cannot hamper his own movements by looking after his prizes. He must send them away to the prearranged place, and they must be manned by men drawn from his own crew; and in this lies a danger, for it impairs his own efficiency. Up to a certain point this may be remedied by the cruizer carrying more than her proper complement in order to

supply the prizes; but when once any of the proper crew are sent away, it may be difficult to replace them. The probability is that many prizes will have to be destroyed, regardless of the consequences. This was the method adopted by the Southern cruizers during the great War of Secession. The receipt is a simple one, but it requires great consideration. The case may often occur in which a cruizer is compelled to destroy its prizes; but, putting on one side the open brutality of this practice, every prize represents not only a sensible loss to the one side, but a corresponding gain to the other. Ship and cargo often represent a very high value, the destruction of which in no way counterbalances the loss. If anywhere, the old maxim of Wallenstein has force, "that war should support war," it is in cruizer warfare. According to our view, prizes should never be destroyed, except in cases of extreme necessity. In order to observe this rule, care must be taken that cruizers are fully manned, and thought must be given to the filling up of vacancies caused by sending men away in prizes; and in drawing up any plan for cruizer-warfare, this is a point which will require grave consideration, and will necessitate, with many other details, careful working out.

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We will now turn to the second kind of cruizer warfare, which has for its "objective" the attacking the enemy's coasts. An exact knowledge is needed of these coasts, and in particular of those points against which there is a chance of making successful raids. Success can be achieved by the destruction of military establishments, railway communications, floating matériel, or in the levying of large indemnities, and, besides the material damage itself, the panic caused by such raids must be considered. The naval and military resources of a place and its accessibility must be taken into account before deciding on the possibility of a raid and the manner in which it is to be carried out. It should be a maxim never to undertake such raids at a venture. The carrying them out with rapidity entails systematic prearrangement. There is both good luck and chance in such undertakings, but the experience of war tells us that fortune favours those most, who trust nothing, except that which is unavoidable, to chance. It must further be considered, that any enterprise which has not a fair chance of success had better not be undertaken, unless an indirect effect only is intended by the demonstration. Raids, however, serve yet another purpose. They fetter the hostile forces both by sea and land. An important maxim for such undertaking must be, "sudden appearance and no less sudden disappearance." During the British manœuvres in the year 1889, a division of the so-called Irish fleet, starting from the north-west of Ireland and rounding Scotland, made raids against the east coast of North Britain, and, according to the rules laid down, several seaport towns were successfully laid under contribution. The sudden appearance of the Irish squadron necessitated the Commander of the English Fleet sending as rapidly as possible a strong division from the Channel to the North, as the small detachments available for coast defence were surprised and could offer no effectual resistance, and before the enemy could be driven off, they had raided the whole Scottish coast, and as far south as Scarborough. The attacks upon the individual ports were decided as successful or otherwise by rules, which had been previously laid down. In real war things would probably have been ordered differently; in any case the moving along the coast from port to port made defence easier, as the different places were on the alert as soon as the enemy was known to be in the vicinity. It was also a mistake, if it was intended to operate along the coast without interruption, to make the attack from north to south, as the enemy's headquarters were thus approached nearer and nearer, and as the appearance of the Irish squadron was known immediately,

a collision with the enemy became almost a certainty. Had, on the contrary, the English coast been first attacked, and the expedition had then moved north, a rencontre would probably have been avoided. In general, to follow directly the coast line, especially when the chance of meeting the enemy must be considered, is not expedient, and without doubt it is better that the raids should be made on places considerably apart from each other, as they are more likely then to be in the nature of a surprise.

The sooner after the declaration of war such attacks can be made, especially if they are successful, the more valuable are they, as, while the confidence and the spirit of enterprise will grow on the one side, consternation will spread on the other; the raids will disturb the plans of the enemy and all the more, the less he is prepared for them. It will generally not be so easy at the beginning of hostilities to bring a large hostile fleet to action, and if dependence is merely placed upon the chances of a battle between two fleets, the patience of the crews may be subjected to a severe strain before the fortune of war is tried; but cruizer-warfare in both its forms offers a possibility of more quickly attaining successes and opens a wide field of many forms of activity; it is especially of importance for that power, whose fleet is less adapted for maintaining the war on a large scale and for holding the sea with its squadrons. It is practically a system of guerilla war at sea and should have the same wearying effect; and we are, therefore, strongly of the opinion that too much attention cannot be devoted to this branch during peace.

Cruizer-war must be considered as a means of defence as well as a weapon of offence, and in its defensive form the system may be divided into two parts. The first regards prize hunting at sea; it cannot be denied, as we have already pointed out, that there are many difficulties connected with this question. An important point to be decided is, whether it is better to afford direct protection to merchant ships or whether to attain that object indirectly by hunting down hostile cruizers. Direct protection is not easy, as it entails the utilization of a considerable force for the purpose, and leads to a sensible splitting up of strength. Every single steamer cannot be accompanied, and in view of the constitution of the seaborne trade of the present day, convoys cannot always be formed. One maxim may be safely laid down, viz., that an attempt to protect everything will lead to nothing being efficiently protected. Efforts must therefore be directed to minimizing this result as much as possible. A certain amount of risk is unavoidable. Should the merchant fleets of the two countries at war be tolerably equal in value, then it might be best by taking the offensive to seek a counterbalance to the action of the hostile cruizers, by doing as much damage as possible. The enemy then will eventually be compelled to give up the chase himself and turn his attention to the chasers. But where there is not this proportion and one side has a commercial superiority, then the point is, that the available force for defensive purposes should be distributed over those waters where the trade is especially threatened, and, if possible, ships should be made to take certain routes, so as to render the task of protection easier. Chains of posts being formed along these lines, to which all the information with regard to hostile cruizers should be transmitted. Just as careful an organization is required for the defence as for attack, headquarters interfering and regulating all movements as requisite.

If the ideal could be attained, it ought to be much simpler to take defensive measures, in which the co-operation of special war ships would be needed to a much less extent. This would be done by merchant vessels being put into a position to defend themselves. This capacity for defence would be an indirect one, where vessels are possessed of great speed and so are able to avoid a pursuer and prevent his approaching sufficiently near to use his guns; it would be direct, if, in certain circumstances, they could engage the

enemy with a view of disabling him and effecting their escape. At present such defensive qualities are only found in a few merchant steamers, which have already been noted as auxiliary cruizers in certain navies. One of the questions of the future, however, will be, what is the simplest and best method of giving merchant ships a certain amount of defensive power?

The question of coast defence lies in quite a different category. Here fixed factors only have to be taken into account, and the system of defence can be organized on a firm and tangible base. Before attempting to lay down precisely the duties connected with it, we must make a few general observations. Four points have to be considered: first, the defence of the great maritime arsenals; then the possibility of invasion; the contingency of a blockade; and, lastly, the repulse of hostile expeditions.

The defence of large maritime arsenals is connected essentially with the so-called squadron-warfare (Geschwader-krieg as against Kreuzer-krieg, cruizer-war), as such places, on account of their extensive fortification, can only be attacked by a powerful force, which is all the more requisite, as the fixed defences of these places will almost always be supported by the co-operation of a portion of the fleet, and the attacker must be ready at any moment to resist succours coming from this source.

With regard to landing on a hostile coast, in the opinion of many, such operations can and will play a great part in the future, and the effects are studied, which might be produced on the theatre of war by the sudden appearance of a large Army Corps off the coast. The idea has a good deal that is enticing in it; a large force, suddenly appearing from the sea at certain points of the coast, would have a disturbing effect, and if a landing was successful, the plans of the enemy might certainly be disturbed. But the question is, whether, in the circumstances of the present day, such landings on a large scale would possess much chance of success; and, speaking generally, we cannot say they would. We know very well that we can be shown many successful examples in the history of war, but apart from these, we have to take into account factors to-day, which did not exist formerly, and these very examples almost always show that success was due to quite extraordinary circumstances, and that the enemy nearly always did the worst thing he could possibly have done. A great landing was that of the French under Marshal Bourmont, in Africa, in 1830, before Algiers, and the much-discussed one of the allies in the Crimea, in 1854; but in the latter case the game was not won when the landing was effected; even the victory of the Alma did not decide the success of the operation, because no vantage point was gained by the Allies, and it was only through the flank march round Sebastopol, which, strangely enough, was undisturbed by the Russians, that the Allies gained a pivot in Balaclava and Kamiesch Bay, which guaranteed them free communication with their base—the sea. But we must remember, that the Russians made no attack while the expedition was *en route* from Varna to the Crimea, and they did not even attempt to prevent the disembarkation; so it may well be said, that the Crimean expedition, so celebrated in its time, can hardly be considered an example from which much can be learnt. We must consider what the effect would have been had the Russian Admiral sallied from Sebastopol with his then intact fleet, or with a portion of it, and even, at the risk of sacrificing his own ships, had fallen upon the Allied Fleets, heavily laden and hampered as they were with troops; a catastrophe could hardly have been avoided, which probably would have ended in the retreat of the expedition. Had the attack only succeeded in delaying the landing, at least more time would have been gained for completing the faulty means of defence, both of fortifications and troops.

There were also some important landing operations during the War of Secession, 1860 to 1865, in America, but we need only refer to that by which

General Maclellan transported the Army of the Potomac to Virginia; but in this case the Confederate Fleet was not sufficiently strong to prevent the operation, or to prevent Maclellan using the sea as his base. Of late years there have been no landing operations, on a large scale, in face of an enemy of any importance. In older days there were many such undertakings, but the circumstances were then quite different, and that factor, which cannot be reckoned upon for such operations to-day, namely, the factor of surprise, played an important part.

If this fact is considered, and, in addition, the comprehensive preparations which must be made to carry out a landing anywhere, the correctness of our view will be admitted.

A modern Army Corps, to be fit for independent operations, must consist of a considerable strength, and we are not setting it too high, if we fix that strength at the standard of a corps of medium normal strength; it must consist of all arms, and, even if weak in cavalry, must include a considerable number of horses, as well as a complete equipment of train, &c., which cannot be dispensed with in these days without impairing its power of striking a blow—in short, the impedimenta of such a corps are considerable. Besides, such a body cannot simply be landed on the beach and then left to itself; that was all very well in days when soldiers themselves carried all they required, and it was possible to find maintenance on the theatre of war itself. But to-day a landed Army Corps must have a secure point of disembarkation, which will serve as a base for reinforcements, else the expedition will be hanging in mid-air, and wanting in the simplest element of success. The measures which are necessary, in order to assemble a large body of men, to embark them, and send to sea a large fleet of transports, cannot be kept secret, unless the Intelligence Department of the other side is completely inefficient. The enemy will have information long beforehand of the contemplated undertaking, and he will learn, at least, the probable departure of such a squadron, and will thus never be taken completely by surprise, and he will be able to guess what is intended by the operation; he knows all the points on his own coast where a landing can be effected, and having regard to the position of the war, can weigh what his opponent has in view and what special measures he will be forced himself to take.

The telegraph and railways will assist materially towards the defence against landings, as they permit the rapid concentration of troops at the threatened points, while the co-operation of the Fleet will also materially lighten the task of the defenders. A fleet of transports, however closely guarded, offers many opportunities for bold attacks upon it, and a wide field is here opened for the activity of torpedo-boats; and if the defending Fleet make good use of their opportunities, the invader will probably have lost half his chance before he approaches the coast, and if he sustains much loss, it will become a serious question for him, whether he should not give up the attempt altogether.

If we pass in review, now, the different European coasts upon which a landing on a large scale, not merely a flying raid, could be effected, we can find none where all the chances are not in favour of the defence. Except under such favourable conditions, which cannot in these days be counted upon, the possibility of a landing can hardly be seriously considered, where all the means of modern war are at the disposal of the side which is attacked, especially as all are agreed that the weapons of to-day place great advantages in the hands of a coast supported also in its defence from the sea. In a general strategic plan of campaign landings will scarcely be taken into consideration, certainly not at the commencement of a campaign, and so long as the enemy can dispose of his means of defence intact. Whether at a later period, when severe losses may have been sustained and a moral

depression may consequently have set in, such an undertaking might have a measure of success, we are not prepared to deny; this, however, will not weaken the general propositions we have laid down.

With regard to that description of coast attack which takes the form of blockading, we have already, in an earlier stage of this discussion, pointed out that the weakness of the blockade lies in just those elements which constitute the strength of the defence, and that a coast properly provided with the necessary offensive elements forms the effective weapon itself against blockaders. This provision consists of coast batteries, mine fields, &c., a properly organized system of observation and signal stations, and a due proportion of torpedo-boats. Effectual defence against raids by cruizers is not quite so easy, as it is necessary to be always on the *qui vive*, and so much depends on local authorities, as help from elsewhere might come too late. But all those points which could serve as objects of attack to an enemy should, as far as possible, have direct protection, at least to the extent of heavy gun emplacements, boom and mines defences and detachments of troops, who could be called upon at the shortest notice; still it may be impossible always to guard against surprises, and therefore the approaches to the coast should be watched by ships; it is impossible to lay down any fixed rules, so much must depend on the nature of the coast. There are two ways open, either to have a cordon of despatch vessels, which shall be in close touch with signal stations, or else of vessels whose duty it would be to engage any enemy on his appearance; large torpedo-boats would prove here probably of great value. Of course, where a large defence coast squadron is available, the situation is much simplified. It after all comes to this, that the whole system of coast defence must be carefully organized in peace time, and as far as practicable be tested by manœuvres, in which ships should be directed to act as if in reality against a hostile coast. Practice can alone determine what is and what is not feasible in actual war, and many faults in detail may be laid bare which otherwise might have been passed over; and by practice alone can Officers and men gain experience and confidence.

Nobody will deny that it is necessary to study the strategical-operative (*sic*) side of naval war with as much care and industry as the technical-tactical side, and it is this consideration which has impelled us to this discussion, which will have effected its purpose if it should serve to direct further attention to these themes.

CONSIDERATIONS ON THE EMPLOYMENT OF TORPEDO-BOATS.

(From the "Internationale Revue über die gesammten Armeen und Flotten.")

(Translated by Captain J. F. DANIELL, R.M.L.I.)

VARIOUS journals have announced the fact that the Naval Authorities in Italy have pronounced their judgment against the employment of torpedo-boats for war purposes, and that the Government has consequently resolved to stop the further building of these boats, and to devote the money voted for naval purposes to the greater development of battle-ships proper.

The object of this article is to examine this subject, and to consider the various opinions which have been pronounced during the last ten years on the subject of the employment of torpedo-boats.

As long ago as 1878 the "Revue Maritime et Coloniale" contained an article by Captain E. Serres on the part to be played by them in the attack and defence of fortified places, and deduced the conclusion that they were of value to both sides—to the defence as affording an effective protection, whilst on the other hand, they rendered the task of the attacker an easier one, as they afforded him many opportunities of action, and, owing to their comparatively small cost, he could afford, if necessary, to risk the loss of some boats in the attack. But even then, although at that time there was next to no experience to judge from, Captain Serres was of opinion that Whitehead torpedoes could not be employed in the open sea, though in narrow channels he considered them to be "a formidable weapon." On the other hand, Lieutenant Stschenovitch, of the Russian Navy, was altogether in favour of the employment of torpedo-boats in the open sea, and the "Morskoi Sbornik," in 1879, contained an article by this Officer, in which were the following words: "In view of the brilliant successes gained by Lieutenants Dubasov and Schestakov in the Russo-Turkish War, as well as the exploits of Lieutenant Makarov in the steamer 'Grandduke Constantine,' which he commanded, and the boat attacks led by Lieutenant Zatzarennyi, it would be difficult to find a seaman who would deny the value of torpedoes for naval warfare."

It is true that the author of the article states that torpedo-boats cannot keep the sea, and that their task must be that of protecting the coast against hostile attacks; but he draws from the exploits of Lieutenant Makarov the following lesson: That instead of uselessly exposing the boats of a ship, in the fight, to the enemy's fire, and to possible injury from explosives or the fire of their own ships, it is better to arm them with torpedoes, and to despatch them, thus equipped, against the enemy before the fight. In his opinion battle-ships should be furnished with torpedo-boats, which should be sent off on the approach of the enemy, and the advantage would fall to the side which either had a greater number of boats or whose boats were of superior quality.

It is well known that in Italy and in England this opinion for a time prevailed, and that the Italians designed the "Duilio" to carry two torpedo-boats in the afterpart, while in England, in 1879, the "Hecla" was fitted with six boats. The impracticability of realizing such projects was, however, soon evident.

The attack manœuvres at Portsmouth might have led to some useful con-

clusions on the value of torpedo-boats, had they been better organized. The object of these manœuvres was to test modern weapons of naval war, but the torpedo-boats were only allotted to the side of the attack, and not to that of the defence, while even as far as the attackers were concerned, their principal object was to direct their attention to the destruction of obstacles. To form any opinion from these manœuvres was impossible; no one knew what to think, and the opinions of the umpires differed widely; indeed, controversy rose to such a pitch, that at last the whole operation had to be repeated; but even in the second attempt torpedo-boats played only a secondary part.

However, the manufacture of torpedoes and torpedo-boats continued, and every year progress was made. Now it was increased speed of the boats, now some improvement in the firing arrangements, which brought renewed vitality to efforts in these matters, and the opinion of experts became constantly more favourable to their employment. Thus, in a long article on the development of the Russian Fleet since the Crimean War, Drygalski stated that the opinion of those who wished the operations of the torpedo flotilla to be confined to the coast was not sound, and could only be tenable whilst financial considerations prohibited a further advance in this direction. At the present time torpedo-boats are much more useful in the open sea than along the coast, firstly, because cases in which they can attack a ship at anchor are hardly to be expected now that the subject is not a new one, and that preventive measures have been adopted; secondly, because their appearance on the high seas is least expected, and the ship attacked cannot ward off the combined onset of a number of rapidly moving boats.

In the opinion of the Russian expert, the rôle of torpedo-boats is like that of the infantry of an Army—the large battle-ships should commence the artillery fight, and at the decisive moment the torpedo-boats should fall on the enemy and annihilate him.

The manœuvres of the English squadron in Bantry Bay, in 1883, completely confirmed his opinion as to the attack by torpedo-boats on ships at anchor, for in the night attack which was carried out on the 21st July, by a flotilla of six boats, against the squadron anchored at Berehaven, the attacking boats were discovered at a distance, and received with such a murderous fire, that, in reality, no boat could live against it. However, this result discouraged no one, and the enthusiasm for torpedo-boats was unabated.

The manœuvres of the Russian Fleet, in August, 1884, led to no positive conclusions. Some of the torpedo-boat attacks succeeded entirely, others miscarried, and no sufficient data were furnished for pronouncing an opinion either way as to their value. The German Manœuvres in the Jahde, in September of the same year, taught a useful lesson, viz., that the impenetrable clouds of smoke so shrouded both sides that accuracy of aim and determination of position was impossible. The conclusion was, however, drawn, that this veil of smoke was favourable to the action of torpedo-boats—a conclusion which hardly seems justified, for in such circumstances friend might easily be mistaken for foe.

In 1885, however, a circumstance occurred which redounded to the credit of the torpedo-boat. The French squadron was to be attacked between Toulon and Tangier, by a torpedo-boat flotilla. The moon was at the full, the day and hour of the attack was known, so that all the chances were in favour of the squadron. Nevertheless, the one torpedo-boat which represented the flotilla, and attacked the squadron in front, was only discovered at a distance of 1,000 metres, and at a time when, under ordinary circumstances, it was scarcely possible to ward off the attack, for the boat was going at 18 miles speed, and was able to discharge her torpedo at a range of 400 metres, so it was only exposed to fire for 45 seconds before it had dis-

charged two torpedoes. Had more boats been at hand, so much the worse for the squadron.

Some successful shots by the French torpedo-boats Nos. 63 and 64, which hit their mark while going at a high speed, caused the French naval Officer, Gabriel Charmes, to remark, in 1885, in a pamphlet on the future of the Navy, that the day of armour-clads was over, and that the future belonged to torpedo-boats. According to him, the defensive resources of armour-clads were such that they must either be reckoned as insufficient, or as creating new dangers for the ships themselves, and increasing those already existing. Their means of active defence, by Q.-F. guns, Charmes would not undervalue, but also he would not over-value them. If it is borne in mind that the interval between the moment when a torpedo-boat is sighted and the moment when it delivers its fire is a very brief one, that in such decisive moments the necessary coolness in aiming and firing is likely to be wanting, and further, that the torpedo-boat is constantly changing its position, the hope that such a means of defence will be successful is necessarily but small. The electric light, too, lights up the target for the torpedo-boat, and the crossing of the rays hinders the ships attacked from having a good field of vision. "Even if the enemy is aware beforehand that an attack by torpedo-boats is to be expected, the boats can confidently go to work at night, for the moral effect of such an anticipation on the enemy, by keeping him on a constant strain, creates for them a favourable situation, and is all to their advantage. The great rapidity of the boats, the bad target they offer, which in a sea is even worse, makes them very dangerous to an enemy even if they attack him singly and in daylight, and they are all the more dangerous if they attack in great numbers and from all sides."

In the case of any one who does not share these opinions, Charmes is inclined almost to blame him for selfishness and effeminacy; for since life on a torpedo-boat is somewhat disagreeable and uncomfortable, many are to be found who are opponents to these boats. This, however, will not hinder torpedo-boats from gaining the day in the end. Then the great armour-clads, the important commands, the numerous complements of Officers, the vast dockyards, with many engineers and thousands of labourers, will appear superfluous, and yet the Navy will be what it always ought to be, and now is not, viz., a school of navigation, where everyone finds his allotted post.

Charmes' treatise is very pleasant and very interesting reading, but contains far too much theory.

Lieutenant Weyl, of the French Navy, wrote an answer to this treatise—an answer of sober reason. He reminds his readers that even if armour is held to be useless, and is abandoned, the only result would be that the task of the guns is lightened, for it would only then be necessary to make guns which would fire the greatest number of high explosive shells in the shortest time; but even then the crews must be protected, so that the armour question has to be faced again. Weyl recognizes that torpedo-boats can play a certain rôle, only he is not over sanguine in the matter. He bears in mind that they are subject to many accidents and breaks down in their machinery, that they cannot live long in a heavy sea, and that, even in moderate weather, they are almost uninhabitable. If everything is taken into consideration, the conclusion which will be arrived at is, that sea-going torpedo-boats must be regarded only as avisos of high speed, armed with guns and torpedoes like all other vessels. They can be used for special objects, either offensively or defensively, but in either case must have an assured base of operations, and this base can be no other than the Fleet.

A German Officer also answered Charmes anonymously; and in his answer gave prominence to a question which was shortly afterwards destined to be confirmed by French experience. In the course of his observations he drew

attention to the qualities of the individual. "The art of war, and the means of carrying it on," he says, "have changed, and will still change; invention makes rapid strides; but in the case of the individual man there is a clearly defined limit which cannot be passed with impunity . . . it is an error to base the means of waging war on mechanical powers. Certainly the crews of torpedo-boats will be picked men, but, even for them, existence on these vessels, with their 45 per cent. of engine space, for a prolonged time will be unendurable, and the most excellent warlike qualities will be paralysed. To take exceptional powers as the standard in organizing and choosing means of warfare is unsound reasoning."

"The man who is trained to fight afloat is, after all, but a man, or rather an individual, who, amid a maximum of self-sacrifice and privation, yet needs, at times, a minimum of comfort, whose nature claims her due, and whose organization cannot be regarded as a piece of clockwork machinery. This is, however, what happens if tactics are based on such means of warfare as these."

We see thus that the arguments for and against torpedo-boats had already assumed a definite shape, and had begun to provoke an animated discussion: a result which is satisfactory, as from discussion ultimately springs something useful. But, in spite of the difference of opinion as to the utility of torpedo-boats for employment on the high seas, it is noteworthy that no one thought of making decisive experiments on a large scale. In the English summer manœuvres of 1885, mines and booms played an important part, but the torpedo-boats had to act rather as avisos, or as ordinary steam-launches. The lessons which England gathered from these manœuvres were of the nature of a warning, for, whether it was that the material was bad, or the personnel untrained to its use, accidents to torpedo-boats were the order of the day. On the 11th June, during the first night operations, two torpedo-boats broke down in their machinery, while two others collided, and had to be run ashore. At another time one of the boats lost a blade of its propeller, and here again the boat went ashore. In defending the Fleet at anchor against the attack of torpedo-boats the method adopted by the Admiral was most effective: none of the ships exposed to the attack used their electric light, but the corvettes and gun-boats which had search lights were so arranged that they could illuminate a broad zone round the field of action of the armour-clads. No torpedo-boats could thus get within firing distance without crossing this zone, and the result was that in spite of repeated efforts they were always discovered and driven back by a hail of bullets.

At the time of the last-mentioned manœuvres, T. W. Dubassov wrote an article in the "Morskoi Sbornik" on the tactics of torpedo-boats, in which he expressed himself as follows with regard to the rôle of these craft: "In the opinions pronounced on the object which torpedo-boats should endeavour to attain, there is far too much optimistic judgment, and there are some who maintain that sea-going torpedo-boats are qualified to act as cruizers; but opinions such as these, which are especially prevalent in French naval literature, are certainly exaggerated. In attacking a hostile coast, the attacker can make no use of his torpedo-boats unless he is in presence of a fleet, and in the latter case all depends upon his distance from his own harbours, for if he has no harbour at hand in which to coal, his torpedo-boats would be in a bad plight. On the other hand, in defending a coast torpedo-boats are of great importance, for if the locality of the attack is within their radius of action, they can themselves act offensively, either alone or with the fleet." Admiral Elliot, however, continued to regard the torpedo-boat as one of the principal elements of future naval warfare. In his pamphlet, "A Treatise on Future Naval Battles, and How to Fight them," published in 1885, he laid great stress on the presence of torpedo-boats in the next naval battle, and sketches the tactical principles which should guide their action. The intro-

duction of torpedo-boats is, he said, a highly important factor in estimating the relative strength of fleets, and there is no doubt that in the next battle these craft will play an important part. "The creation of a strong torpedo flotilla is thus the shortest and the best way to protect one's own coasts, on the one hand, and, on the other, to gain for oneself favourable chances in future naval battles." Admiral Elliot was, however, far from expecting torpedo-boats to do everything; on the contrary, he urges the necessity there is for England to build large ships. "Great Britain must be superior in battle-ships, cruizers, gunboats, and torpedo-boats." In his pamphlet he further expresses an opinion adverse to the exclusive employment of torpedo-boats for coast defence. He clearly sees how dangerous they would be by night, and recommends the attacker to stand out to sea before dark. By day their approach would be discovered, and single ships must then manœuvre to keep them long enough under fire to destroy them. But if the torpedo-boats were accompanied by other ships, they could shelter themselves behind the latter and watch for a favourable moment for action.

Rear-Admiral Fremantle, while combating the exaggerated ideas of Gabriel Charmes, yet, in his paper read before the United Service Institution in 1886, gave due weight to torpedo-boats; and the fact that to a squadron of 12 armour-clads he would allot 12 vedette ships, 24 torpedo-catchers, and 50 sea-going torpedo-boats speaks for itself.

As far as the actual fight is concerned, he was of opinion that no Admiral —at any rate in the early stages of the battle—would expose himself to the danger of being struck by a torpedo. The fleets would have to keep at a respectful distance from one another to let their guns have due effect. In his opinion torpedo attacks by day are not to be expected, but by night they must be seriously borne in mind. He seems, however, somewhat to contradict himself, for his tendency is decidedly to attach rather small value to torpedo-boats, and yet he says that they will have an important influence in finally deciding a battle.

Lieutenant Sturdee, in his Prize Essay, is of opinion that in a battle between armour-clad fleets torpedo-boats will play an important part. Whilst he compares favourably the accuracy of aim of the Whitehead with that of heavy guns, he remarks, truly, that in torpedo-boat attacks the principal thing is to have a number of swift boats to act simultaneously.

Whilst among younger men the use of torpedo-boats was defended with so much enthusiasm, Commander A. Becker, of the Austrian Navy, in an article on "Night Attacks by Torpedo-boats," written in 1887, made the following wise remarks: "By young Officers torpedo-boats have been welcomed as introducing a new era, in which the mythical times of Marryat's Lieutenants and Midshipmen are to return, with even renewed energy, and the young Officer, who for years has been a watch-keeping Officer on board frigates and armour-clads, hopes that, as Commander of a torpedo-boat, he will be able to exercise that independence which our fabled Boat Commanders enjoyed in their young days, and which in war is the road to the highest distinctions for the enterprising."

We may fitly conclude the enumeration of the theoretical opinions which have been pronounced on torpedo-boats, with some remarks by a distinguished tactician and strategist, F. Attlmayr. In his treatise, "On the Fundamental Organization of a Modern Fleet," he writes as follows: "With regard to the great effect of torpedoes, the rapidity of movement of the torpedo-boats, and the small target which they offer, the battle-ship can, by itself, no longer be regarded as sufficient for its own protection; it requires something outside itself—something, too—if it is not to be hindered in its movements or even condemned to remain stationary—which possesses in itself power of movement. In our opinion such means of protection are to be

found, firstly, in torpedo-catchers, and, secondly, in torpedo-boats. The latter should accompany battle-ships, especially on the grounds that the best method of defence often lies in assuming the offensive, since it is not only a question of warding off an attack, but also one of making an attack by means of the same weapon which can prove so dangerous to the ship attacked."

"The modern battle-ship should therefore be regarded as a unit of the fleet, only in connection with torpedo-catchers and torpedo-boats; even cruizers can only dispense with these adjuncts if they are remarkable for great speed, or have to operate in waters far from any coast."

We have thus summarized the principal opinions which have been pronounced of late years on the employment of torpedo-boats, and it is to be observed throughout that no expert has ventured to speak absolutely against them, but rather everyone has handled the subject with more or less respect. We reserve our own opinion for the conclusion of this article, and now proceed to examine the experience which has been gained in the last three years.

All the experiments made before 1886 as to the value of torpedo-boats for use in the open sea, as sea-going vessels of war, have been, as we have already remarked, almost without result. In 1886, however, the French Government made a very instructive experiment. Torpedo-boat No. 61 was ordered to proceed from Brest to Toulon to test its value as an independent cruizer. On the 30th January the boat left Brest, but had to put back the same day on account of weather. She pitched so heavily that the propeller was often out of water, to the risk of the engines and the serious diminution of her speed. On the 2nd February she resumed her voyage, but found a somewhat heavy sea, and had to put into Camaret to repair the watertight arrangements of her torpedo-tubes. An increasing S.E. wind compelled her to run into the harbour of Douarnez on the 3rd. On the 4th the barometer went up, and she proceeded on her voyage. She then met with a heavy sea which shook her greatly. She was very lively, and the working of the engines was most irregular owing to the propeller being so often out of the water. Again she had to run for shelter, and put into Morgat. The Captain did not venture to proceed across the Bay of Biscay. From Cape Penmarch he steered for Oleron, anchored near the island of Aix in a heavy sea, and then went into Rochefort to clean the engines and boilers, and to give the crew some rest.

On the way to Ferrol, the boat leaked so much that she had to put into the latter place; she was making water so fast, that it could only be kept under by combined steam and hand pumping. An examination of the injuries sustained revealed a rivet hole of 7 mm. diameter in the bow, evidently the result of her violent pitching. In the remainder of the voyage there is nothing to remark.

The commander of the boat must have been an optimist, for, in spite of this obvious failure, he rendered a comparatively favourable report of his voyage. He only complained that in heavy weather he could not slacken speed as required without exposing the vessel to the greatest danger from pitching. When steaming 8 knots against wind and sea, the waves swept clean over the boat from stem to stern. "The torpedo-boat is seaworthy," said the report, in conclusion; "life on board is endurable, the hardships not intolerable, and the wetness not specially inconvenient. The commander can get his food from the men's galley, which can prepare a proper meal."

"By night it is very cold; by day very hot if the sun shines; but such inconveniences are of little consequence. The rolling is not excessive, even in a very heavy sea."

"With the sea astern, the boat travels smoothly and hardly rolls at all; but with the wind and sea ahead or on the quarter it is dangerous. The sea then sweeps over the boat from one end to the other; the wind cuts in one's face,

and one is choked with coal dust. With the high speed, though reduced as much as can be, the boat labours heavily, and one would wish to be able to reduce the speed still more. This too high speed in heavy weather lessens the value of the boat, an evil which must be remedied; it strains the boat, has a demoralizing effect, and at last makes it necessary to run for shelter in order to get relief from the pitching, which, in the enormous seas raised by the wind on the French coast, is positively frightful."

The cruize of this boat gave the opponents of torpedo-boats an opportunity of making themselves heard. Lieutenant Weyl immediately published an article prefaced by the remark that the experiment made by No. 61 was altogether superfluous, for no one could have any doubt as to the result, and closed with an attack on the French Ministry of Marine. "However incomparably valuable the torpedo-boat may be in calm weather," said Lieutenant Weyl, "it is no cruizer, which can be counted on under those circumstances in which sea-going ships would not hesitate to go into action. In short, torpedo-boats, torpedo-gun-boats, and cruizers under 1,800 tons (obviously too high a figure) are nothing except vessels with a limited radius of action, and are incapable of keeping up with a squadron, especially if it consists of battle-ships with a speed of 17 to 18 miles, such as are now being built in England."

The position of the French Ministry of Marine became in the face of these circumstances a very difficult one. On the one hand, the supporters of torpedo-boats had become so powerful that there was already some intention of suspending the further building of armour-clads, while, on the other hand, the unsuccessful experiment above related afforded matter for serious reflection. In this condition of affairs Admiral Aube determined to make an experiment on a large scale of the capabilities of torpedo-boats, and the French manœuvres of 1886 were designed for this purpose, and form an epoch in the question. It is thus necessary to consider them somewhat in detail.

The conditions under which a ship was to be considered out of action were as follows:—

1. A torpedo-boat was to be considered as put out of action if it remained exposed to the fire of a revolver cannon for fifty minutes without coming to sufficiently close quarters to make a certain shot with its torpedo, or if exposed to a single shot from any other gun, provided that the torpedo-boat was visible at 500 metres and remained continuously within the line of sight of such gun.

2. Every torpedo-boat which by day or night was surprised in harbour was to be considered as captured.

3. Armour-clads without torpedo-nets were to be considered as out of action if two torpedoes were fired at them within 400 metres. If they had nets, the torpedoes must be fired directly against the bow or stern.

The ships engaged were as follows:—

Armoured squadron (Vice-Admiral Lafont), in two divisions:—

8 armour-clads.
2 cruizers.
3 torpedo-catchers.

Torpedo-boat flotilla (Rear-Admiral Brown):—

3 cruizers.
1 coast defence vessel.
17 torpedo-boats (1st and 2nd class).

The exercises to be carried out were divided into three groups.

Group I. *Exercises before Toulon.* (*a.*) General idea: Admiral Lafont is to bombard the unfortified harbour of Toulon. The torpedo-boat flotilla is to prevent such action.

Admiral Lafont waited patiently for a favourable opportunity of carrying

out his design. By day he only made a feint of attacking, whilst by night he anchored in the roadstead of the islands of Hyères, and took all precautions not to be surprised by torpedo-boats. At last, on the fourth day, a fresh S.E. wind got up with a heavy sea, and, as the battle-ships were able to use their guns in spite of the weather, he judged that the right moment had come; so, shortly after midday, he opened a brisk fire on Toulon. Admiral Brown was not ready for this attack in such weather, and twenty minutes were lost before the torpedo-boats were under way. They were then received with such a fire that they unquestionably failed in their attack. The fleet bombarded the town heavily with their big guns, and kept off the torpedo-boats with their revolver cannon. It must be borne in mind that in the heavy sea the torpedo-boats could hardly fire any torpedoes with safety.

(*b.*) General idea: Admiral Brown is blockaded in Toulon, and is to endeavour to break the blockade.

Again the torpedo-boats miscarried, owing to the excellent dispositions which Admiral Lafont had made.

Group II. *Manœuvres near Corsica and in Ajaccio Harbour.* (*a.*) General idea: Admiral Lafont is anchored off the coast of Provence, and receives orders to put to sea, to round Cape Corso within 20 nautical miles, to steam along the east coast of Corsica, and to reach the harbour of Ajaccio by the Straits of Bonifacio. Admiral Brown is to prevent these movements, and to destroy the enemy's squadron.

In order to deceive the enemy, Admiral Lafont covered his movement by making diversions in three different directions. The ships which carried them out succeeded in attracting the attention of the torpedo-boats, leading the latter to divide their strength, tiring out the crews, and in protecting their own squadron.

Lafont himself once came within sight of some torpedo-boats, but skilfully evaded pursuit by sending one ship after them while he altered course with the remainder of his fleet.

In rounding Cape Corso about midnight he was prepared to be attacked by at least two groups of boats, but actually he only met one group of three boats, which he easily rendered harmless.

The torpedo-boats had thus contributed little to the solution of the problem. The cause of this was partly owing to a collision between two of them, whereby one was sunk. This circumstance discouraged the Admiral, and it was also reported that the crews of several of the boats were worn out in consequence of their exertions for the two previous nights, and were consequently unfit for work. Thus it was impossible for him to concentrate the requisite number of boats to be able to attack successfully.

(*b.*) General idea: Admiral Lafont is seeking shelter in the open roadstead of Ajaccio, belonging to the enemy, in order to repair damages and give his men some rest. The torpedo-boats are to attack him.

It is hardly worth while to say much about this; it is sufficient to say that the weather was bad, and that the boats were not in a condition to make the voyage from Bastia to Ajaccio. They laboured heavily, and shipped so many seas that most of them were in serious danger. Out of twenty-one boats, to which number Admiral Brown's flotilla had been reinforced, only five arrived at Ajaccio fit for action. Admiral Brown attacked only half-heartedly, and the result was a foregone conclusion.

Group III. *Manœuvres near the Balearic Isles.* General idea: A squadron coming from Gibraltar is going to Toulon, and will pass within a given radius of the Balearic Isles. A torpedo-boat Division is to attack this squadron. Should the squadron succeed in approaching within 15 nautical miles of the French coast, the expedition will be considered to have been successful.

On the 25th of July Admiral Lafont left Oran, and steered at slow speed

towards the Balearic Isles. Warned by his recent experiences, Admiral Brown had left his 2nd class torpedo-boats behind, and had only twelve 1st class boats, which lay near the islands, protected by cruizers.

On the 27th the enemy came in sight, and Admiral Lafont then steamed at full speed.

In the earlier part of the manœuvres the armour-clads had carried position lights, but now all lights were extinguished. The torpedo-boats attacked by night with the following result:—One boat fired at a passing merchant steamer, another torpedo hit a friendly ship, and only one of the enemy's armour-clads was struck. The Fleet steamed away from Admiral Brown's division at 11 knots, and reached the French coast. From this it appears that after four days' steaming the torpedo-boats, with their theoretical high speed, were no longer in a condition to steam 11 knots.

These manœuvres also show that when the field of action is extensive, and torpedo-boats are required to act for a prolonged period as sea-going vessels, they are not to be trusted, and will fail.

In view of these well-considered manœuvres, it is not necessary to delay long in considering the English manœuvres at Milford Haven in the same year. No conclusion can be drawn from them as to the utility of torpedo-boats for coast defence. Neither do the manœuvres in 1887 present any special points of interest as far as torpedo-boats are concerned. In 1888 the French again carried out manœuvres on a large scale. Three general ideas were laid down, and were as follows:—

1. An armour-clad squadron was to cover the transport of troops from Toulon to Algiers. A torpedo-boat flotilla from Corsica was to prevent the operation.

2. The armour-clad squadron was to proceed from Toulon to Brest, while the torpedo-boat flotilla was to prevent the operation.

3. The armour-clad squadron was to enter the Mediterranean, while the torpedo-boats were to oppose their passage through the Straits of Gibraltar.

Admiral Brown was in command of the torpedo-boats, while Vice-Admiral Peyron commanded the squadron.

On the 14th May the squadron left Toulon. As the weather was at first very bad, but afterwards abated, Vice-Admiral Peyron judged that the boats would not attack him at sea, but close by Algiers. He accordingly shaped his course for Cape Dellys, and regulated his speed so as to arrive at this point at dawn on the 16th; then he wished to get concealment under shelter of the mist along the Algerian coast at that time. He desired, in the case of an eventual attack, to have the sun behind him, so as to have a clear view ahead. The weather, however, in Corsica had been such that the torpedo-boats could not get to sea till the 16th, so that the transports and the squadron easily reached Algiers. All that remained for Admiral Brown was to attack the ships on their return. He accordingly sent some boats to Algiers to observe the enemy, while he kept the main body near Cabrera. On the 23rd the squadron got under way, observed by the enemy's cruizer "Villars." In vain the cruizer sought to invite pursuit, so as to bring them near the main body of the torpedo-boats. Admiral Peyron was not deceived, and steered eastward. Admiral Brown accordingly resolved to await the squadron 60 miles south of Toulon, and started for that spot, where he arrived at midnight on the 25th. At daybreak the ships were not in sight, but he gathered from information brought in by his scouts that they were to the southward of him. The weather now became bad and the barometer fell; so, as Admiral Brown could now only attack by daylight, which presented no chance of success, he resolved to give up the pursuit and to proceed to Toulon. This failure seems to have convinced the authorities that in manœuvres in such a wide field the torpedo-boats must get the worst of it.

This confirmed the experience of the previous year, so the rest of the programme was abandoned, and the manœuvres were brought to a close.

What, then, is to be gathered from all this? That torpedo-boats are not suitable as fighting craft in the open sea, and if the resolve of the Italian authorities relates only to their employment as sea-going vessels it is a right one.

We can go still farther, and say that in the French manœuvres the conditions imposed on these boats were too great. Reasonable men could hardly have imagined that torpedo-boats could act as independent cruizers. It is requiring the impossible, to ask that torpedo-boats alone should oppose a squadron on the high seas. The mere fact of their limited coal and water supply, and of their crews being too small to endure prolonged duties, excludes them from such work. Finally, the weather has to be taken into consideration, for it will not always be favourable enough to admit of torpedo-boats attacking.

The French manœuvres teach us further that a torpedo-boat must go into harbour at a time during which cruizers and battle-ships are perfectly capable of going into action.

England, Germany, and Italy seem to have recognized these principles from the first, for in their summer manœuvres these Powers have not attempted to employ their torpedo-boats otherwise than as coast vessels. The torpedo-boat cannot, however, be condemned on that account, for in coast defence the torpedo is, and will be, a most formidable weapon. If, in the manœuvres which are carried out every year, so many torpedo attacks are successfully warded off, we must still leave it as uncertain whether this result would be confirmed in real warfare.

Let people say what they will, the appearance of a group of torpedo-boats in sight of a ship cannot fail to have a moral effect, and the question will be, with what accuracy of aim will the machine-guns be worked? If it is remembered that one boat will never attack singly, but that the boats may make their attacks from different directions, it is evident that the task of defence will be all the more difficult. Thus no country will venture to strike out torpedo-boats from the list of their coast defence vessels. Even Italy will not do this, and the resolution she has arrived at probably only means that the existing number of boats is not to be increased, a resolution which she can very well afford to come to, as she already possesses a very considerable torpedo-boat flotilla.

When we say, however, that torpedo-boats are unsuitable as sea-going craft, we do not mean that they should be excluded from the line of battle on the high seas. Suppose that war breaks out between France and Italy. The two fleets may be so close together that their torpedo-boats could very easily take part in the operations; for example, why could not two fleets anchored at Toulon and Genoa take their torpedo-boats with them, provided that on the day of their action the weather is favourable? Even if the weather becomes bad there is always time to return. In such a case the torpedo-boats would very properly be given their rôle in the event of a battle.

The torpedo-boat is in existence, and to strike it out of the list of the fleet is not such a simple matter. The manner and method of the effect which it will actually produce cannot be foreseen, but it can be said with absolute certainty that it will strive to push in everywhere, and will produce a lasting impression, for which people are hardly prepared. The torpedo-boat will play the part of one who, when kicked out of the door, comes in at the window. We apologize for the trivial comparison, but that is just how the matter stands. There is one thing, moreover, which must not be overlooked, to which we attach no small importance, and that is that in the nature of things torpedo-boats are commanded only by junior Officers, while that youth

makes little of hazardous enterprises and is accustomed to act with boldness and dash—that the feeling of honour is keen in youth, and that at that period of life a man readily and cheerfully risks his own life and that of others to gain fame is a well-known fact. What young Officer is there who, if he once smells powder, does not reckon a decoration or an honourable death as of much more value than life? In the next war this factor will have to be reckoned with in no small degree.

But to wish to base all one's defensive power on torpedo-boats would be madness. The opinions which have been quoted in this article have furnished ground enough to make it unnecessary to say more on this subject.

TACTICS AND VERTICAL FIRE.

A Winter Lecture delivered to the Officers of the Fortress of Ingolstadt.
By Lieut.-General von Sauer.

(Translated by permission from the German by Captain E. H. Bethell, R.E., Brigade-Major, R.E., in Ireland.)

N.B.—In the following translation the terms "gun-fire" or "horizontal fire" are contrasted with the term "vertical fire," which means the fire of mortars and howitzers; and the clumsy term "vertical fire piece" is generic, includes mortars and howitzers, and is contrasted with the term "gun."

Gentlemen,—You had the goodness last year to give your kind attention to my views about shortened methods of attack on fortresses and their repulse. This encourages me to speak to you to-day about a question which lies nearer to all of us than fortress warfare.

This question is the battle of the future, and, therefore, includes both attack and defence, and I shall address myself especially to the manner of conducting the attack and the defence in the battle of the future.

I willingly confess that the immediate motive for my present address has been furnished by another tactical treatise which has made a deep impression, not only in your own, but also in the widest circles. I allude to the valuable work of Major Keim, Battalion Commander in No. 136 Infantry Regiment, which contains the substance of a lecture delivered to the Military Society in Berlin, and which the "Militär. Wochenblatt" has printed in the 1st Beiheft of the current year.[1]

The name of it is "The Present State of Tactical Science and Battle Training."

During the perusal of this I felt that, in spite of the opposite intention of the author, the deduction that the defence had become the stronger form of battle might be drawn from Keim's arguments. Two recent essays have borne me out here; they appeared in No. 13, and Nos. 17 to 20 of the "Militär. Wochenblatt" of 1890. One is called "The Improvement in Armaments and the Offensive," and the other "Tactical Examples from 1859 to 1890, with special reference to Infantry."

The authors of these two treatises have certainly felt as I did, and have thrown their weight into the scale to help to restore the attack to its rights as a well-considered form of battle. The circumstance that neither Major Keim nor the writer of the essay No. 13 of the "Militär. Wochenblatt" mention a weapon, on the effects of which I should wish to base my deductions, chiefly animates me with a desire to throw my weight into the same scale. The allusion to this weapon in the above-mentioned "Tactical Examples" is in agreement with my views, but the essay does not go far into the subject.

[1] A translation of this by Major W. Sawyer appeared in the Occasional Notes in No. 152 of the Journal.

The weapon is vertical fire. The "Tactical Examples" say of it: "The idea that vertical fire is wanted elsewhere than with siege artillery may be considered as established;" and add: "the Russian Army possesses already complete field mortar regiments, and light mortars, for taking into the field, will soon be ready almost everywhere." The latest innovation in Austria, too, as we know, has been completed by the establishment of mortar field batteries, and you yourselves have seen mobile mortar batteries take part in field manœuvres. Therefore, the artilleryman may take Keim's words, "Most tactical books are written by infantry men," as a hearty invitation to him to supplement and complete them. This attempt is further justified, because Keim's requirements that "the infantry Officers should make themselves better acquainted with the fire effect of artillery, and industriously visit the practice-ground, so as to see with their own eyes what the effect of artillery is, and to estimate its effect in battle," has not, so far, been fulfilled. It is needless to say we shall be glad to see this suggestion carried out.

If we follow the particular manner in which the artillery has been developed in the last 300 years, we must allow that it would be much harder *now* for the infantry Officer to get a sufficient *tactical* illustration of the fire effect of artillery than it was in the days of smooth-bores. All who, in those days, visited a practice-ground learnt there nearly all the trade secrets of the disciples of Barbara, and saw how guns and howitzers (that is horizontal and vertical fire pieces), placed together in the same battery, could be used. Apart from the consideration that this is now only possible to a limited extent, we have to reckon with the fact that field guns and vertical fire pieces belong to two different kinds of artillery, of which we can by no means assert that they are connected in the same way as are heavy and light cavalry.

The circumstance that modern field artillery knows nothing but flat trajectory guns has led to the general omission from tactical teaching of a kind of artillery fire which field batteries now no longer have at their disposal.

The times change, and we change with them. Thirty years have now elapsed since the last smooth-bore gun was introduced into the field artillery. It was a light 12-pounder, which was taken to the war of 1866, but its performance did not at all come up to the expectations formed of it, and it very soon had to give way to rifled guns. But he who can carry his thoughts back so far will remember the advantages which were boasted for that field-piece, copied as it was from the French "Canon obusier Napoléon."

There were voices that prophesied for it a greater future, at least for field service, than for the rifled guns; and what was it that was specially praised in the 12-pounder? That it fired horizontally and vertically.

Slight as was the accuracy with which it fired vertically, it gave more chance of hitting than did the smooth-bore howitzer, and this was recognized as an improvement to be thankful for. If at that time rifled howitzers had been introduced, with rifled guns, would the idea have been formed that tactics could dispense with vertical fire? If we doubt that fact, we may on the other hand accept this: that the entirely separate lines on which guns and vertical fire pieces have been developed must necessarily lead us to many kinds of tactical errors, to eliminate which we must take immediate action, because the vertical fire piece has reached an equality with guns in general, and with field guns in particular.

Our fathers knew what they wanted howitzers for in the field, and we, too, must learn to find out the help which the vertical fire piece may afford, not only before positions in position and fortress war, but also against positions in field war.

As you know, vertical fire in the time of spherical projectiles was the only means of firing hollow projectiles; the effect of these was then considered (especially the moral effect) so decisive that there was no doubt about adopting them, even along with the slowness and clumsiness attendant at that time on shell fire, which was then remarkable for its inaccuracy and its short range.

With the introduction of rifled guns, the advantage credited to the above-named 12-pounder was attained, viz., that horizontal fire guns fired shells. By this means a particularly highly valued and entirely peculiar quality of vertical fire became common to guns also; but the guns being rifled, had the additional advantage of more accuracy and greater range than the smooth-bore mortars and howitzers. Thus it is easily explained why it was sought to replace the slow vertical fire—at all events for battle—by the gun-fired shell. The attempt was first made to provide the rifled guns with diminished charges, so as to be able to use not only horizontal but also vertical fire, as had been done with the 12-pounder; but the result was about the same in this case as with the 12-pounder.

It is natural that a gun should answer only one object well, and any secondary object indifferently. If it is decided to renounce neither, then both will suffer, and thus it happened in our case. If the twist of the rifling was right for high charges, it could not possibly be sufficient for low charges, if the fuze was made right for the shock of a great charge, then, sometimes, shells did not explode with the small charge. Hence, we cannot wonder that, with us, it was soon decided to aim at the perfection of one object, and to leave the attainment of the others to the future. It is equally comprehensible that good gun shooting, as being the object required to be attained in the first line, was aimed at and vertical fire left alone, for the actual battlefield fire will always remain flat trajectory fire. Here we may blame the arrangements of France and Austria, who kept the diminished charge for field pieces, while we kept them only for a few old fortress guns.

Many people held to the opinion that, however great velocity was given to the field guns, they could still be used with sufficient success for position warfare, and that shrapnel would, at least, make it dangerous for an enemy behind good cover. It is especially noticeable that on this point the author of the "Tactical Examples" of the "Militär Wochenblatt" feels himself compelled to speak as follows: "The doubts whether the improved shrapnel could succeed against earthworks, which were first raised after 1878 (but not by the artillery), were at first rather hastily decided against, but were afterwards considered justified." We, too, must acknowledge that these doubts are justified, and must add the necessary consequence of this confession; for, however many ways of improving guns are arrived at, there must always be two points on which horizontal fire must be beaten by vertical fire, viz., the steep angle of fall of the shell and its fragments, and the possibility of having the hostile mark under fire from entirely unseen positions.

Shells and shrapnel fired from guns, too, are effective by their burst and splinters, but this effect is different from the effect of burst of shells in vertical fire. Let us assume that the shell from a gun reaches the mark with a terminal velocity of 900 to 1,200 feet, then it is demonstrable that both fragments and base of the shell will move forward towards the mark at that velocity. Thus we get depth of effect towards the front, but a very moderate effect in width; and this quality of the effect of gun-fired shrapnel must become more marked as the trajectory is flatter. It is exactly on this depth of effect that the artillery rightly lay much stress. Even the use of high explosive bursting charges will not turn this "deep" effect into an all-round effect until the explosion is strong enough to give the fragments of the shell a much higher velocity than the terminal velocity of the shell. Artillery-

men, however, recognize that it is harder to get a decided superiority of velocity from the burst over terminal velocity, in proportion as the latter is higher and the bursting charge smaller; but it is exactly these two qualities (high velocity and small space for bursting charge) which we find in the shells of field guns.

In vertical fire it is otherwise. Here the velocities are small, and the shot themselves—and, therefore, their internal contents and bursting charges—larger; hence there is no difficulty, especially when high explosives are used, in developing bursting velocities much higher than the terminal velocities of the shells. This, and the steeper angle of descent of the shell, constitute the great difference between horizontal and vertical fire.

Now consider the case of a mortar (or howitzer) shell, just as we did of the shrapnel shell, at the end of its flight, but before it touches the ground, and therefore a few yards from its goal; the shell is filled with a high explosive, and is exploded by a time fuze; in this case you do not, indeed, get a very "deep" splinter effect, but you get instead of it a very murderous all-round effect, which can only be compared to a destructive hail.

Against the perfectly vertical fall of most of these iron hailstones, no breastwork gives any protection. A body of men under such fire can only escape it by a change of position, and we must further observe that the same shell charged with a high explosive can penetrate every head cover which in field warfare can be opposed to the action of its burst.

But not only has the destructive force of modern vertical fire become altogether extraordinary, but also its range is so little inferior to that of guns, that the inferiority makes no odds in battle, while its accuracy at the decisive ranges, from 1,500 to 2,000 yards, is rather superior than inferior to that of guns.

Regarding the complaint that used to be made in the days of spherical projectiles of the *slowness* of vertical fire, it may be observed that Grüson's works already produce a 12-cm. (4·7-inch) howitzer for field service which can fire twenty shots a minute with very good effect.

I may here observe that the solution of the question of quick fire for guns is sensibly checked by the fact that it is indispensable to check the recoil completely.

This requisite is, on account of the inferior velocity of the shot, more easily satisfied with howitzers than with guns, with which latter more rapid fire remains inseparable from diminution of calibre.

Modern armament having at its disposal pieces for vertical fire perfectly suited for the field, both howitzers and mortars, perhaps I may, with reference to the difference between these two, adduce the fact that the service and handling of howitzers approaches more nearly to that of guns than the service of mortars does, that mortars, on the other hand, may often be more completely removed from the enemy's sight than howitzers, and, above all, that they have steeper angles of fall than these. On the other hand, howitzers can, if necessary, deliver a fire with a somewhat flatter trajectory than mortars, and can therefore defend themselves better. Howitzers for field use are seldom of larger calibre than 12 cm. (4·7 inches), with which calibre they are to be classified for weight and mobility with field guns, but can in the same space carry only half the ammunition that the guns can.

Field mortars, of that you have convinced yourselves already, can be classed as suitable for the field up to 15 cm. calibre, but again can only carry half the ammunition the 12 cm. howitzers can carry. The decision for one sort of piece or the other must depend on whether more reliable

mobility and easier ammunition supply is more important than great penetration and explosive effect. If we believe that the enemy, even in the field, must above all be destroyed in his casemates and with them, and if the resistance of these is reckoned nearly as high as that of provisional and permanent fortifications, then the larger calibres will hardly be left behind; if, on the other hand, we think it sufficient to hit the unhidden enemy, and if we consider the strength of field casemates unimportant and systematic bombardment of unseen casemates too wasteful of time and ammunition, then we shall prefer the smaller bores. These are questions which must be decided by trial and experience, and the decision will depend generally on what is the smallest bore which is fully sufficient to effect the purpose in view. But for the purposes of tactical instruction these considerations affect us much less than does the difference that exists between horizontal and vertical fire. When a vertical fire battery fires out of a glade in a wood, or behind the crest of a hill, it remains, especially with smokeless powder, entirely hidden from the enemy; but it cannot possibly see the effect of its own shots from its position. Thus the shooting for range of the battery and its fire in general must be directed and watched from a point which affords a complete view of the mark which is to be shot at. It is very conceivable that a small field telegraph may be required in order to transmit the orders as quickly as possible to the battery. It is also conceivable that the battery will sometimes find it most simple to take its direction of fire from the compass, and if you remember that the time of flight of a shell is as much as a quarter and even half a minute, then you will see that the shooting for range can only in exceptional cases be done as quickly as that of a gun battery. That, however, does not prevent the rapidity of fire being very quick when once the right position of the trajectory has been found; this will be rendered easier for vertical fire by the larger bursting charge and consequent smoke cloud of its shell, by its sharper angle of fall and lower velocity, and above all by the earthworks of the enemy. It is just these field-parapets that show themselves by the fresh heaps of earth against the background of the fields, and there is seldom in these cases time to provide good masks. But bad masks often serve to show up well what they are meant to hide. Masks, moreover, injuriously affect one's own field of fire, and it is the defender who wants this most. In proportion as he allows due weight to this consideration, his position must become more visible to the enemy. Against the horizontal fire of the attack this matters little, unless it takes any of the trenches in flank; but with vertical fire it is quite different. Nothing can assist the trial shots for range in the latter case more than a clearly visible breastwork, or any visible heap of earth; and nothing will more entirely demoralize the men hidden behind this cover than crushing proof of the uselessness, even the harmfulness, of their laboriously erected cover.

But the effect of even good masks in increasing the difficulty of the trial shooting, and the destructive effect of the hail of vertical fire is much less than their effect in misleading and injuriously affecting horizontal fire from guns, and the latter can by no means produce the damaging results against woods and localities, and above all against their hedges and enceintes, which vertical fire produces.

You see from this that we shall in the future have to do with quite another vertical fire than that of the time of spherical projectiles. For the attempt made in old times, in fortress warfare at least, to produce a hail of splinters with the bursting of the shell, by cutting of their fuzes short, may be compared with the result aimed at under modern ballistic conditions, modern fuzes and high explosive bursting charges, in the same way as the arquebus may be compared to the infantry rifle of 1888.

Thus in the present vertical fire we possess really an entirely new but none

the less decisive weapon, and that weapon, gentlemen, has, in my opinion, been placed at our disposal just at the right and most important time to remove the doubts as to the superiority of attack with which the small calibre rifle and smokeless powder invade us.

As all tacticians, including Keim and even v. der Golz, in his "independent patrols" recommend to the defender the greatest possible use of the spade; as the horizontal fire of field artillery, either with shell or shrapnel, cannot drive the enemy out of his position, nor yet sufficiently shatter him in it, to allow the attacking infantry to advance against the hostile lines without overwhelming losses, I ask you whether we do not give new life to the attack by providing it with a weapon which enables it to be confident of striking the enemy most sensibly exactly where he has thought himself strongest.

Let him fortify himself to his heart's content, the more he does so, according to known methods, the more surely will the iron splinter hail of the attack unite over his supporting points. But where this is the case, there is only one thing to do, and that is to evacuate the position which becomes otherwise an inevitable grave. If the defender has prepared himself field casemates and drawn back into them, then, whether or not he is shattered with them, I hold that the infantry will always think the artillery has done it good service in compelling the enemy to retire into the doubtful shelter of the casemates.

The enemy who in the old days withdrew from the shot-torn parapet into the blockhouse that served as *réduit*, or into some similar shelter, was as much to be feared in this as he was before at the parapet, and likewise the defender who sat at the foot of the breastwork and saw almost the whole artillery fire of the enemy whistle harmlessly over his head, but who stood up directly it ceased, and overwhelmed the approaching enemy at the best ranges with his rapid fire. But to-day the question is another. What are now built for blindages and casemates are no longer defensible buildings. They are arrangements for shelter, which must be left if the position is to be defended. Now it is impossible on account of vertical fire to await the storm at the foot of the interior slope, and if this waiting must be in casemates and such like structures, then I will suggest for consideration this question—What is there to guarantee the certainty that these casemates will be quickly enough exchanged again for the fire-line when the latter has to be held?

I have already (*à propos* of my "Sketches of Shortened Fortress Attack") spoken so clearly on this point, that I should be afraid of wearying you with repetitions if I tried to recur to the simple possibility of wearing the enemy out by false attacks whenever he retired into his shelter. On the other hand, I ought to remind you that the defender, whom modern vertical fire compels to retire under his bomb-proofs, takes with him to his cellar-like abode ideas of this fire which are as demoralizing to him as they are encouraging to the attack.

If you have to allow that up till now the attack possessed no means of surely bringing about that discouragement in the enemy, then you will agree that modern vertical fire is a very important addition to the strength of the attack. But the strength of this support is enhanced by the fact that the vertical fire accompanies the advancing infantry up to the threshold of the place which is to be assaulted, and thus, if the enemy has left his shelter, can keep him down as no other weapon can.

As long as powder-smoke interrupted the view, one might have been anxious as to how far the artillery support could go on; but now no smoke hides the lines of the defenders nor the advancing lines of the attack. Thus there is no danger for the latter while the former are themselves a mark. We may further add that the vertical fire of separate vertical batteries is

much easier to watch than the flat trajectory fire of a great field artillery position. Now the advance of the infantry has always been supported by artillery fire up to the present date, but in order to afford this support effectively, it was often necessary for the field artillery to limber up and accompany the infantry attack. You know that this proceeding of the field artillery involved not only the temporary interruption of its fire just at the moment when it was most wanted, but, also (and this, too, you know), this impetuous advance involved losses, which turned the result which it helped to gain into a very Pyrrhus' victory.

The nearer the small-bore rifle and the depth of effect of field artillery have brought us to this danger, the more welcome will be the support to the attack of vertical fire, which necessitates neither a change of position for the battery using it nor a pause in its fire, but which could support an advance of the field artillery, if this were necessary, in a manner not hitherto possible. Moreover, it is quite conceivable that it might require effective vertical fire to enable the field artillery to take up the position required.

If the artillery of the defence is favourably placed itself and strong enough to keep the attacking artillery from every favourable position, will not the latter willingly remember the demon power it possesses in its vertical fire? As soon as it uses this aright, the horizontal fire of the defence will not cause it any anxiety, for an inferior number of vertical fire batteries will suffice to keep down, tactically, the stateliest array of hostile field guns. These latter are utterly unprotected against the vertical fire batteries, and while the guns must be placed so as to have a clear field of fire, and, therefore, be exposed to view, they cannot touch a hair of the heads of the well-covered vertical fire batteries; for this dangerous enemy of horizontal fire can only be fought by vertical fire. This would not be easy if the vertical fire piece were compelled to give itself away to the gun by exposing itself; then it would be, anyhow, a question of straight shooting, and it would depend on that whether the vertical fire battery was silenced by the guns or *vice versâ*. But what inducement is there for the vertical fire battery to expose itself to the gun fire? It is at once indifferent to the former whether it fires straight against the mark or obliquely, and whether it stands higher or lower than the mark. It is the only kind of artillery which can fire away over its own field batteries and other troops without the least inconvenience. It never draws the enemy's fire on the troops in front of it, because, on account of smokeless powder, the enemy can neither see its fire at all nor by means of it descry its position.

It may, in so far as its range permits, fire from one wing of the battlefield against a mark in the middle of it and *vice versâ;* it does not sensibly cramp any other troops in space for movement or position, as the only question for the troops would be whether to place themselves in front of it or behind it when it came under effective fire. Is it any very great feat so to place a vertical fire battery (provided it has sufficient mobility) 1,500 or 2,500 yards from the defender, as not to be visible by him, and, therefore, so as not to come under the fire of his guns? In answer to this question I may remind you that I gave you the opportunity last year of convincing yourselves how easily vertical fire batteries, even in broad daylight, and with a faultless outpost system arranged for the purpose, could be brought up even to fortresses and open fire.

It is exactly this power of covered approach and this invulnerability by horizontal fire, on which the very marked superiority of vertical fire rests.

Even if we assume that field artillery succeeded by means of high-explosive bursting charges in getting good results against troops behind visible breastworks and such like earthworks, we must never forget that these field batteries remain exposed to the fire of the enemy's field batteries and of his

vertical fire batteries. I must also claim for vertical fire the advantage that it can not only prepare the attack in a most reliable way, but that, if the attack is repulsed, it can take the retreat under the wing of its effective protection.

If the vertical fire battery need not cease its destructive fire until the attacked had got within a couple of hundred yards of the enemy, and if a repulse then took place, there would be nothing to prevent the battery firing again at the original mark directly the attacking troops had retired those few hundred yards. This kind of support you can only give by fire with a steep angle of descent, and if the defender has a just idea of it, it will scarcely stimulate his powers of resistance.

With this idea of the tactical use of vertical fire, I take up, no doubt, a somewhat different standpoint from that assumed, for instance, by the author of the essay (undoubtedly a thoroughly competent writer) on "special batteries of the field army," which you received with the volume of the "Year Book for the German Army and Navy," issued last January.

In this valuable essay it is proposed not to allow the vertical fire batteries to come into action except as special batteries, outside the frame of the field army. These detached batteries, then, are not to be used for the general purposes of the artillery, but exclusively for the following object, viz., "immediately before the decisive attack to keep the part of the position where the attack is to break in, and its supporting points, under a well-considered fire, a fire which shall guarantee success, during which the attacking lines will approach as near as possible to the enemy's position, and towards the end of which the final assault will be made." Then, further on, it says that "the opening of the vertical fire should not take place till the hours that have passed have drawn the picture of the battle in sharper outline, and when nothing is to be expected that could justify a cessation of the vertical fire, when it had once begun." Thus the object of the special batteries is fulfilled when the moment arrives for assault, whether success crown it or not. The *rôle* the vertical fire batteries have to play is finally compared to that of the great batteries of Napoleonic tactics; for it is said that these correspond exactly in their object and value to the special batteries. Let us hope that in a future war they will gain as great successes as did those. I do not wish to diminish that confident hope when I say, that between the great batteries of Napoleon and the special batteries described here there are practical differences, and that those differences are in respect of their tactical use.

Those great batteries were the same approximately as what we nowadays call the corps artillery. They were, therefore, part and parcel of the field artillery, and, as we know, were then divided into light and heavy batteries, of which the latter had the 12-pounders; the first, the 6-pound gun, and both had the 7-pounder or 15-cm. howitzer.

Now Napoleon at any rate had no idea of placing his vertical firing pieces together in separate batteries, and only using them when the last decisive moment was imminent. The heavy batteries, which, on account of their weight, moved something slower than the light batteries, showed the enemy, by their louder sound, that now they too had come on the ground and had joined in at the right point to supply the energy still wanting to make the last resistance yield. Here it was not a question of the relation of tactics to vertical fire, but only of a reinforcement of gun fire generally just as reinforcement of infantry fire is the rule for the last preparation for the assault. To carry out this reinforcement with the proposed special batteries alone, at any rate, would only be possible when the attacking artillery had been able to cope with the enemy's field guns. But this can only be expected in the rarest cases, for not only will the favourable deployment of the field guns of the attack be hindered by those of the defence, but also

the guns will be opposed in a yet more energetic way (and of that I should like to speak more fully) by the vertical fire of the defence.

If the defence has howitzers or mortars, then undoubtedly it will be in a position to keep down the whole horizontal artillery fire of the attack thoroughly and to make all support of the attacking infantry by the guns extremely doubtful. How under these circumstances does it fare with the requirement of the "tactical examples," according to which the advance of the attack has tied to it the condition that "the attack has succeeded in breaking down the artillery of the defence, and in concentrating, with what artillery remains over from the duel, on the hostile infantry"?

In the discussion on "special" batteries it is true the author says, that the proposals advocated allow the defenders to make the most extensive use of vertical fire from unseen positions; but, he says, "that that is only an apparent advantage, for that all its successes could not be decisive, if the attacking troops use their power of free movement, change of position, and make skilful use of the ground, while the fighting power (*i.e.*, the ammunition) of the defensive 'special' batteries is meanwhile gradually consumed and is nearly exhausted at the moment when the attacker's vertical fire batteries appear on the scene. I have not brought this theory before you in order to discuss it thoroughly, but I should like to put this one question concerning it: how is the field *artillery* of the attack by free movement and change of position to shelter itself from the vertical fire of the defence?" An army corps has roughly 100 guns; are they to gallop about the battle-field, up and down, to escape the enemy's vertical fire? Or are they by skilful use of the ground to choose positions where they will be concealed from it? How will they be able from such positions to engage the enemy's field artillery? And if they fail to do this what sort of a look out will it be for the free movement of the infantry?

I think these few hints serve to show the difference there is between an active and effective support of the attack and the task for which in the "Year Book," a special battery is required for each army corps. The "Year Book" remarks that this addition depends on the proceedings of other nations; that where, as in Russia and Austria, vertical fire batteries had been formed on an extensive scale, there could be no longer any question of "special" batteries, but only of heavy batteries of field artillery, to which the principles established for the "special" batteries would not apply; it continues: "Then with one word a light but mobile field artillery would have become effective but helpless,—exactly what the 'special' batteries by their peculiar use are intended to prevent."

Is this last sentence really to be taken to mean that field artillery must take care not to be effective, so as to remain mobile enough? Are only 'helpless' guns to be in a position to make good the defects of the light guns? I will not pursue these questions farther, but will only remark that every arm which is to be fit for use in field war and able to support field troops must be mobile enough to be able to follow these with certainty. That, too, our forefathers knew, and they fulfilled the requirement with their guns of position. But of "special" batteries, as they recommended to be used in the "Year Book," there are no historical counterparts. Now, if I have indicated that under certain conditions I should consider the destruction of the attacking field artillery by the vertical fire of the defence possible, I must add that I, nevertheless, think the latter little dangerous against a well led attack.

By this I understand that the attacker is careful not to offer the fixed targets so desirable for the defender's vertical fire, as for instance a field artillery position.

Considering that the vertical fire batteries of the defence are hidden, it

will be very hard for the attacking field artillery to find suitable positions for itself; but the advantage for the attacker lies in this, that this difficulty will matter little to him if he has vertical fire batteries at his disposal. If the defender could destroy these, it would be a bad look-out for the attack; fortunately such an event is improbable.

To establish this point, I must again remind you of the difference which exists between the tactical object of the attack and that of the defence.

The one purposes to hold a certain position, the other purposes to drive his enemy out of it; the first offers, on the whole, fixed, the latter moving targets.

With the defence everything is as much as possible prepared, with the attack the arrangements are often not developed till the attack has begun.

It is exactly this last circumstance which forms, I am convinced, the real Achilles heel of the defence. If uncertainty can even in ordinary life put one into a state of the most painful disturbance, this feeling will be heightened in the turmoil of battle.

The defence is opposed to this uncertainty; it supposes indeed that the attack will proceed in such and such a way, but it knows nothing and will be at least as often mistaken as correct in its suppositions. It is otherwise with the attacker; if he, too, is often enough mistaken, yet it is always something definite, both in purpose and its execution, that is opposed to him by the defence. However much the latter hides itself it can scarcely make itself invisible.

If it neglects the maxim—"First fire, then cover," it transgresses most against itself and will be easily overcome. How dangerous earth works may be to the defence we have already heard; but he who wants to obtain a good fire effect can never withdraw himself entirely from the enemy's view, except in the one case of his using vertical fire. Now it might appear very advantageous for the defender that he should command the whole field with entirely unseen vertical fire; but it is this uncertainty which might rob these "ostrich" tactics of their result.

If the battalions of the attack are well led—the defence sees nothing of how this happens, and whither it tends, behind what hillock, clump of trees, &c., they take up their position, and is often almost entirely incapable of shelling these positions. But if it really can do so it will probably be much more often possible for the batteries of the attack to effect a sufficient change of position behind their cover than for those of the defence, which perhaps instead of changing their own position keep the original hostile position under fire. On the other hand, the more fixed and longer prepared forms of the whole defence have the effect of enabling the attackers to draw conclusions from what is seen, about that which is not seen; and if he is never secure from false conclusions, any more than the defender is secure, yet a correct conclusion on the part of the attack entails much more that is disagreeable for the defence than is the case *vice versâ*.

For the defender has already chosen throughout the best position, if therefore he is obliged to alter any part of it, he generally incurs a disadvantage thereby. I do not mean by this to recommend that the vertical fire batteries of the attack should altogether look on the engagement of their hostile sister batteries, as their principal task, especially when they can only engage them with slight probability of hitting. It is much more important that they should remain withdrawn from the enemy's view and be able to destroy those hostile targets, which are sufficiently clearly seen for that purpose; not only will there be no lack of these, but they will be just the factors of the defence which hinder the attack most, and those are not the vertical fire batteries but the gun batteries and the infantry fire.

Vertical fire can only be carried out with any prospect of success against

fixed targets; horizontal (gun) fire must be used against moving targets. That is the reason why every defensive position is so well fitted for a mark for vertical fire, while every movement of attack can only be resisted by the "deep" effect of gun fire. When, therefore, the vertical fire of the attack has succeeded in keeping down and shaking the field artillery and infantry of the defence, then it renders possible a forward movement of the attacking troops. Herein lies the truth that vertical fire is a much more important reinforcement of the attack than it is of the defence; and that it is the weapon, by the just appreciation of which the attack remains the stronger form of battle. It is, therefore, the attack which, for its initiation and entire conduct, can less dispense with vertical fire than it can with gun fire (though it must, of course, have the latter to beat back counter-attacks); while, for the defence, to repulse attack, guns are more indispensable than vertical fire pieces. This condition of things is not altered till the attack adopts the forms of the defence, and, consequently, makes earthworks and occupies positions against the defence (as especially pointed out in the "independent patrols") instead of remaining in motion.

My propositions for attack differ accordingly from the forms used up to date only in so far as they substitute effective vertical fire for gun fire, wherever this latter seems to be the less effective of the two. Thus I sum up my views as follows:—first, thoroughly good intelligence and reconnoitring of the enemy; opening of the battle by properly led vertical fire batteries; forward movement of the attacking troops (which have been held in readiness under cover), not till the vertical fire, which has been chiefly directed against the hostile field artillery and the fortified supporting points of the defence, has had sufficient effect, and thereby all superiority of the hostile horizontal fire—especially at the point which is to be assaulted—has been thoroughly overcome; next, move as near the decisive ranges as the vertical fire allows; then make sure that the defence is sufficiently shattered; lastly, assault.

But I must here expressly say that, in spite of its great tactical importance I by no means wish to see vertical fire looked upon as a universal panacea. The attacked can no more think of covering whole battlefields with vertical fire than can the defender; rather it is just he that must be clear on this point, that all dispersion of fire is bad and only concentration of fire is tactically effective. As to this every modern defensive position will offer enough decisive points to keep the attack from the attempt to fight long thin lines instead of their supporting points.

I do not mind, gentlemen, if this plan of attack reminds you of my reflections on fortress warfare, and impresses it on you that I incidentally treat the attack in the position-battle just as I do that against fortified points. I willingly profess this view as to the similarity of the two cases, and have convinced myself of its truth since the readoption of vertical fire, and have from that time invariably held it. If it is right, then, you will not consider there is any disadvantage in the fact that the Commander who can win a battle thereby shows how he intends to plant his colours on the works of the enemy.

If you reply by asking me what is going to become of the defence, I can only reply, that I in no wise doubt that it cannot possibly be wiped out from the world by my attack tactics; but that I am convinced it is now the turn of the defence to see that its uses, forms, and means of support which do not practically betray its positions and favour the shattering effect of vertical fire, in cases where it does not seek its remedy in motion, *i.e.*, in well-arranged retreats (as 1812). Concerning the search for new methods of support, I should remind you of the overwhelming report on the last Imperial manœuvres in Hanover.

If the defence still scorns to consider the new course, then it will be its own fault if it has either to yield entirely to modern attack or evacuate its positions before it, without being able to hold them with the murderous gun fire, only, of whose invincibility it is so convinced. This invincibility will, doubtless, remain, when the attack is weak in vertical fire batteries; but I think the want of these may be easily supplied. It ought to suffice, and to correspond to the earlier historically proved relations between horizontal and vertical fire guns, if one vertical fire battery were allotted to each brigade.

Turn four companies of the foot artillery regiment of an army corps into as many field vertical fire batteries, and the four brigade batteries are ready; one can hardly conceive a simpler reinforcement of the field artillery, nor one more valuable tactically, but it is beyond the scope of our present conference to discuss whether this reinforcement is provided to meet the conditions of our case, and if so, how.

This, however, I will affirm, that in the next war the attacker, who scorns to make a right use of vertical fire, would challenge his opponent to meet him in prepared positions and to convince him with bloodiest energy of the power of resistance of the latter. Allow me to add to my modest contribution to tactical science a few words about training.

Years ago, when I gave you my thoughts about fortress warfare, it was urged against me that I demanded abnormal work from the troops, and, above all, their abnormal co-operation. I do not deny that, but I ask you whether the demands I have made are greater than the attack itself demands, at any rate greater than its execution at Plevna demanded.

What was the use then of the extraordinary strength in artillery, which the Russians developed, to the attacking infantry? Do you disagree with me because I wish to support the infantry by an artillery which can and must relieve it of the preliminary work of attack, without the certainty of which relief the success of the assault seems very doubtful? a preparation which cannot be left to the fire of the attacking infantry, but which must, undoubtedly, be effected by the attacking artillery. "The infantry attack," says Keim, "which has to advance through artillery fire in its principal stages, has no hope of success; it is by the proper application of vertical fire that the attack can best deliver its infantry from the dangers of such an advance." But how the effect of vertical fire can be estimated in peace manœuvres, seems to me, at any rate, a difficult question to solve. In most cases a body of troops will not be at all aware of the presence of the vertical fire batteries, from whose murderous fire they are suffering, and you will see that this is also an advantage for the attack—for you can practise it—on the sound understanding that the vertical fire, especially in such a case, will have been effective, and hence that the assault of the infantry will have been thoroughly well prepared. But the defence training is much more difficult to arrange similarly; the troops of the defence are exposed to a fire of which it is impossible beforehand to ascertain the resisting force.

The practice ground must naturally show the nature of this fire, as it does that of infantry fire, and its lessons will, of course, not be accepted until the practice ground becomes the manœuvre ground. But as soon as vertical fire batteries are distributed in these battle practices, as well as the field batteries, the Commanding Officers who attend will have ample opportunity of estimating the fire effect of the one, as they do of the other.

There, commanders and umpires will very soon get familiar with the effect of vertical fire, although it may be difficult, on account of the great distances at which vertical fire is opened, to estimate its probable effects on manœuvring troops.

It will be much easier to learn another, not less important, part of the attack of the future thoroughly, viz., reconnaissance of the enemy. That

alone can keep us from making attacks which may well seem much more dangerous with modern arms than they were twenty years ago. Who will complain if, instead of these attacks, we have only well-considered and well-prepared assaults? But to arrive at this we must have such a reconnoitring service as can only be learnt by strenuous practice, and for which neither good eyes (or really corresponding glasses) nor the clearness and quickness of sight, which are indispensable, must be missing.

The training in co-operation of the different arms will offer no invincible difficulties.

They are, after all, under one command, and though a certain drawing together and mutual understanding may be desirable, where is the difficulty in bringing this about?

When the infantry and field artillery once know the powerful reinforcement which may be derived from vertical fire, they will not be behindhand in coming forward unreservedly, in order to ensure to themselves the valuable co-operation of the new weapon; and, as the tactical laws which determine the manner in which this weapon co-operates are the simplest imaginable, the requirements of the latter will very soon be intelligently appreciated, and the service of the vertical fire batteries assisted by every sort of intelligence and information.

The impedimenta inseparable from those batteries will soon be considered real value, and not looked on as ballast; and, of course, the vertical fire batteries will wish to show their thanks by deeds.

In doing so they must think especially of their chief duty, viz., to deserve the confidence reposed in them, by their deeds; they will deserve that best by never endangering their own troops by their fire.

They themselves will seldom be able to see whether the enemy, on which they pour their iron hail, is really crushed by it.

Only the front line of the attacking troops will know this, and must, therefore, take care that the vertical fire is regulated as may be required, and that it ceases at the right moment, or is resumed, as the course of the fight requires.

To teach this in peace is, perhaps, more difficult than to practise it in war. Meanwhile, though it may appear to require German repose and conscientiousness, German industry, and German thoroughness, to solve all these problems, yet I do not think that, while the motto on our shield stands, any aim will seem to us too high on account of the difficulties which beset its attainment.

NOTES ON MANŒUVRES OF THE PRUSSIAN GUARD CAVALRY DIVISION, 1890.

By Major EDWARD HEGAN, 5th Dragoon Guards, D.A.A.G.

THE Division commenced its manœuvres at Lüben, Silesia, on the 30th August, and ended them on the 10th September, after which it was ordered to march to Liegnitz, to take part in corps manœuvres commencing on the 17th September. I did not witness the corps manœuvres.

The Guard Cavalry Division, under the command of Lieutenant-General Edler von der Planitz, consisted of the following regiments :—

Gardes du Corps Regiment.	1st Guard Ulan Regiment.
Guard Cuirassier Regiment.	2nd Guard Ulan Regiment.
1st Guard Dragoon Regiment.	2nd Guard Dragoon Regiment.
Leib Guard Hussars Regiment.	3rd Guard Ulan Regiment.

Mounted detachment (three batteries) of the 1st Guard Field Artillery Regiment.

The Division was divided into 4 brigades of 2 regiments each. Each regiment had 4 squadrons in the field, the remaining squadron having been left behind at Berlin to take part in the manœuvres of the Guard Army Corps. Each squadron was about 120 strong in men and horses, but only turned out on parade about 80 horses strong during the manœuvres, this with a view to resting some of the horses each day.

The Divisional Staff consisted of two "Captains of the Great General Staff" and one Division Adjutant, who was a Major *à la suite* of one of the regiments. There was also a Brigade Adjutant in each brigade.

The Division, which has its permanent quarters in Berlin and Potsdam, left Berlin on the 15th August, and reached Lüben on the 29th August, marching about 15 miles a day, and practising every day, either while *en route*, or at the conclusion of the day's march, drill, reconnaissance, outpost duty, or some other work. Rivers that came in the line of march were crossed by swimming, or by bridges built by the troops for the occasion.

On the conclusion of the Corps manœuvres round Liegnitz the Division would commence its return march to Berlin, which it expected to reach on the 6th October.

I did not see any swimming done, but I was told that no accidents of any kind occurred when it was practised on the march. A few men in each squadron used to swim the river themselves, being provided with drawers for the purpose. The remainder crossed by boats or bridges with the saddlery.

For the manœuvres the squadrons were billeted in farmhouses and villages all round the country for several miles—one squadron had to march 13½ English miles to the drill ground every day, while several had to come distances varying up to 7 to 8 miles.

The Divisional headquarters and those of one brigade were in Lüben, and use was made of the barracks there to accommodate as many men as possible —the cavalry regiment usually stationed at Lüben being itself away at

other manœuvres. The Officers and men were billeted in private persons' houses as well as the public houses.

The physique of the men was very good, but the guard cavalry possess the best men physically and morally. They are recruited from all over the kingdom, not from any particular district as is the case with the other corps; and, owing to the large number of applicants for the Guards, the squadron Commanders can pick and choose their men; also the number of one-year volunteers is much larger in the Guards than elsewhere.

Hence the men are of a superior class in every way—and there is very little crime among them.

The "Garde du Corps" and "The Guard Cuirassier" men were very large, heavy men, certainly too large for the horses they rode; the ulans and dragoons were about the same size—smaller a good deal than the cuirassiers, and the hussars were smaller than either. Ulans, dragoons, and hussars were very sturdy, thick-set men, apparently well-fed and strong, with open intelligent faces, and good bearing.

It is now considered that the cuirassiers are too heavy for cavalry, and I believe it is proposed that men of this stamp should be used for artillery in the future.

About thirty reserve men had been added to the squadron for the manœuvres. I asked the opinion of several Officers as to these men, and gathered from them all that they were excellent in every way. For the first day or two after joining they are awkward at riding, but they seem very soon to get over that, and they do not seem to forget their military duties—such as care of horses, drill, patrolling, habits of discipline, &c.,—at all. Some Officers said the reserve men were the best they had. None of them had been away more than two years since their last service, either at manœuvres, or while actually serving their first period.

A great number of the men serving their first period were in their fourth year. It appears that if a man voluntarily elects to serve four years instead of three, he thereby absolves himself from the necessity of rejoining afterwards for drills as a reservist—and many avail themselves of this condition. I do not know if this arrangement obtains throughout the army.

A great many reserve men (cavalry) never come up for training at all. The number of men that can be trained each year is limited by the number of horses; and therefore any man who can give a fair excuse can always get leave of absence from training.

There were three different kinds of saddles in use. The cuirassiers had a large, flat, heavy saddle of old pattern, and the ulans and dragoons had what is called the "bock sattel," also well known.

The hussars had a new pattern saddle, as to which there seemed to be a variety of opinions. I was told by some of the hussar Officers that the saddle was very satisfactory, and that they had no sore backs on the march, but from what other Officers told me, I am not sure this was correct. It is doubtful whether the saddle will be finally approved for general service.

I got a non-commissioned officer of the hussar regiment to bring one of these saddles and explain it to me. It seemed to be heavy, and the non-commissioned officer told me that although it was generally approved of in his regiment, it was uncomfortably broad in the seat for a hussar, and it was apt to cause sore withers unless very carefully fitted. The panels are stuffed like an ordinary English hunting saddle, and if a sore back is caused, it is proposed to chamber out the stuffing to relieve the sore part, instead of using straw pads as with the old pattern saddle. There is no high cantle behind.

The new saddle gives a better looking seat than the "bock" saddle, which throws the rider very much forward on the fork. The latter is very short

in the seat and very high behind, but there seems to be an idea that this throwing the man forward is an advantage to a soldier using a lance, as it gives him a purchase behind.

The men carry the sword round the waist by the old-fashioned belt and carriages, but there is some talk now of attaching it to the saddle. The carbine is carried attached to the off wallet by straps.

During the manœuvres, in order to save weight on the horses, neither swords nor carbines were carried at all until the last day, when swords only were carried. Pouch belts were also only worn on the last day.

The cavalry have not yet got the new magazine carbines, but expect to receive them during the winter. Some Officers have been instructed in their mechanism and use.

Lances were carried every day by all the regiments and by all non-commissioned officers and men, except those non-commissioned officers who were actually leading züge.

Officers in general approved of the lance being given to all cavalry regiments, but seemed to think it a mistake to give it to the non-commissioned officers, and some thought it might be better to arm the front rank only with lances. The lance was considered to be too much in the way of a non-commissioned officer, who should have his hands free to examine his map, write reports, and who should be able to dismount readily or conceal himself easily when patrolling. It is, I was told, only owing to the express wish of the Emperor that the non-commissioned officers are armed with the lance.

The lance was always carried at the trail at drill—this appeared to be dangerous, but I was told that accidents with the point of the lance were unknown, and only rarely were rear-rank hores hurt with the butt end of the lances of the front rank. Some squadron leaders, according to their own fancy, had pads of some description on the points of the lances in their squadrons, to prevent accidents.

Lances were of two kinds—the old wooden lance, and a new pattern made of iron tubing. It is over 10 feet long, rather heavier than the old one, much stronger. The old one is very brittle and is often broken. The disadvantages of the new iron lance are that it is too thin in the hand, and that in summer it is uncomfortably hot and in winter painfully cold. Leather is wound round the grip, but this only partially obviates the above disadvantages.

All the regiments use blankets under the saddle. They were of two sorts—a white and a grey one. The former is not liked, and will not be issued any more. It is worn folded in four, hangs low, and sweats the horse unnecessarily.

The grey blanket is the last isused, and is found very satisfactory. It is used with the new saddle, folded in nine—first in three lengthwise, and then again in three. It is laid on the horse's back with that end to the front which shows three edges together—consequently there are no edges to the rear. No straps or contrivances of any kind are required to keep it from slipping.

I was not able to see a nosebag, but was told that a very good one was in use, made of "leinwand" or linen, and it was capable of holding water.

The Division included three different classes of horses—all bred in East Prussia. The cuirassiers were mounted on large horses compared with the others, though they did not look at all up to the weight of the men they carry. The hussars' horses were the smallest. I do not think they averaged 15 hands in height.

All the East Prussian horses show a good deal of Arab breeding and "quality." They are very light indeed below the knee, but are well ribbed

up. Officers told me that they thought the breed was deteriorating—that the horses were getting shorter of bone and hotter in temper, but efforts are now being made to improve the breed by importing English thoroughbred stallions and half-bred mares. East Prussia supplies the rest of Germany with horses, much as Ireland supplies England.

However, in spite of their lightness, the horses are able to do a vast amount of work, the smaller ones especially. The Colonel of one of the heavy cuirassier regiments told me he had served in a dragoon, an ulan, and a hussar regiment, and that he had no doubt that the small hussar horse was the best for work.

Nearly all the Officers rode English thoroughbred, or nearly thoroughbred, horses; but they said they did not consider them anything like equal to the East Prussian horse for hard, continuous work.

When I saw them, the horses were, as a rule, looking well—not fat, but in good condition and not tucked up, with the exception of the artillery draught horses, which looked miserable. I do not know how to account for this difference, unless it was that the work was too hard for the artillery draught horses. The horses of the mounted detachments were all right. The draught horses were very light, and seemed hardly able to drag the guns behind them.

The cavalry horses had done a very fair amount of work when they reached Lüben—they certainly lost flesh during the ten days' manœuvres which I saw there, but at the end of them did not look tucked up.

The daily ration in barracks of ulan, dragoon, and hussar horses is 11 English pounds of oats, but cuirassier horses get 12½ lbs. All horses get an increase of 2 lbs. while at manœuvres. The ration of hay is nearly 4 English pounds, with 5½ English pounds of straw to eat. Some of the latter gets trampled under foot and spoiled for food.

The horses are very quiet as compared with ours. They are naturally easier to ride, and they are, moreover, much more highly trained. They are bought as three-year-olds, kept for one year at a remount depôt to grow, and are then sent to the squadrons unbroken. They are ridden in the Riding School for two years, and not till after this do they regularly take their places in the ranks. Thus there were at the manœuvres no horses under six years old. If a horse at the end of his second year's training is still awkward, it is put back into another squad, so that a squadron Commander has always three classes of remounts in hand—those in their first year's training, those in their second, and those in the third, or awkward squad. The consequence of this lengthened training is that the horse is reduced much more to a machine, as it were, than with us.

As regards sore backs, I was unable to get much information; but I heard enough to feel certain that some few, at any rate, did occur during the march from Berlin.

A great deal of attention is paid to teaching horses to jump. During the winter months, and squadron drills, horses have to jump over something or other every day. They are jumped singly, and with a front as large as a squadron in line. Unfortunately, the drill ground at the manœuvres was perfectly open, so I did not see any jumping. Three or four times a year, if possible, horses are swum across a river, opportunity being sought for if it is not close at hand. Men are taught to keep hold of the horse's tail while swimming.

A large number of the horses wore bandages, or boots of different sorts, in the ranks. A good many of them stood over in front and appeared to be "groggy" in the fore legs. I was told that the East Prussian horses often stand over from the time they are foaled, but I do not know if this is really more common among them than elsewhere. The horses certainly showed

signs of wear and tear much more than ours do. A horse is supposed to last ten years with the regiment, but a good many horses are kept much longer. Squadron leaders prefer to keep the old horses if they are sound. No doubt they find them useful for recruits riding, and easier to look after than young horses.

I was surprised to find that the cavalry did not move faster than they did. I do not think they moved at such fast paces, pace for pace, as any good English regiment.

The "charge" was considerably slower than with us—in fact, there seemed to be little, if any, increase of pace from the gallop to the charge. In order to form a correct idea of the paces, I rode alongside squadrons several times when trotting, galloping, and charging, and I found that the 15-hands under-bred cob I was riding could always keep up without any effort.

In the first stages of the manœuvres, when brigades were drilling alone, the paces were purposely kept slow to save the horses. For instance, I once saw a brigade charge at a trot, the men cheering.

The smoothness of the movements was, however, very noticeable. There was never any noise, or appearance of confusion, or bad riding, or variations of the pace, even when, as I saw several times, an entire brigade moved perhaps 2 miles at a trot or a gallop in line of squadron columns at close interval.

Nearly all movements from place to place, even for considerable distances, were done in line of squadron columns at close interval by regiments and larger bodies. I once saw the whole Division in mass of brigades, each brigade in line of squadron column at close interval, advance about a half-mile at a trot, and then shoulder about an eighth of a circle without the slightest trouble.

The interval between squadrons in "line of squadron columns at close interval" is 6 German paces, or 13¾ feet, instead of 8 feet as in England, and the increased interval seemed an advantage—it appeared to make movement easier, as it gave a little more play between squadrons, and seemed to prevent confusion.

When in column of route, proceeding from billets to the drill ground, squadrons move in "threes"—the horses of each three with their noses in line with the tails of the horses in front of them, and covering the "intervals." There was thus no "distance" between threes, and of course a great deal of "depth" is saved as compared with our English column of sections, but the German horses are naturally much quieter than ours, with which such an arrangement would probably be impossible. I asked if horses did not often kick those behind them, or get their heels trodden on, and was told that such accidents are almost unknown, but that some of the horses take a little time before they learn to go quietly in this close formation.

The drilling was always very quiet, and sometimes was conducted by signs only. I watched a brigade execute several successive drill movements by signs, and everything seemed to go just as well as by words of command. Whistles were often used to convey orders according to preconcerted signals.

The cheering of the men during the charge did not seem to have any disadvantages. There never seemed to be the slightest difficulty in halting the men. From the sounding of the charge to the moment of collision with the enemy, no leader is likely to want to give any commands, and the men are not likely to continue cheering during the *mêlée*, so that the noise of the "hurrah" will not interfere with words of command. On the other hand, the cheering seemed likely to have an inspiriting effect on the men.

The marching past by squadrons at a trot was always exceedingly well done. Galloping past was not nearly so good. I saw no other parade movements.

The usual formation of the Division preparatory to forming lines was brigade column, each brigade being in line of squadron column at close interval. I believe the idea is that the preparatory formation in mass should be kept as long as possible—until an idea can be formed of the movements and formation of the enemy—then, as rapidly as possible, the mass is to, as it were, burst asunder, the "formation by lines" is to be taken up, and the attack delivered. The General in command did not, however, by any means always act like this. He generally, when working against the "marked enemy," distributed his brigades about the place, so that the flanking brigades should be already in position to deliver flank attacks when the time came to move. The drill ground was, however, so small that the opposing forces were often on top of each other almost directly they began to move. The normal "formation by lines" was with two brigades in the 1st line, in line of squadron columns, one brigade in 2nd line in the same formation in échelon on one flank of the first line, and one brigade in 3rd line in line of squadron columns at close interval, écheloned on the other flank of the line, or in rear of it. The distances of the 2nd and 3rd lines from the 1st line should be, according to the Regulations, 262 yards and 394 yards respectively ; but these distances were generally reduced by about 100 yards each, and I was told that they were generally considered too large.

According to Regulations, two or three squadrons from the 2nd line should follow in rear of the 1st line, with wide intervals between them. They are given the greatest independence, and are charged with the duty of falling upon any parties of the enemy that may break through the 1st line. However, I only saw these squadrons used once, and then there were only two of them. I asked why they were not more used, and was told it was owing to forgetfulness.

When the Division was working against an imaginary enemy, a charge was almost always executed across the front of the 1st line by the 2nd or 3rd line, after the 1st had halted.

When brigades, or the Division, were working against an imaginary, or the "marked enemy," three or four non-commissioned officer patrols were sent out to the front and flanks, and one man was sent back with news when the enemy was seen. Sometimes ground scouts were sent out too, but very often there were none. I twice saw a whole squadron sent out to reconnoitre, but in both cases they came upon the enemy before they had gone more than a few hundred yards from their own side. On the whole, I do not think that much attention was paid to scouting at these manœuvres.

I did not see dismounted service practised, but gathered that the prevailing idea is that the dismounted action of cavalry will be very useful in future wars. When dismounting with carbines, two men out of each three dismount, the mounted centre men holding a horse on each side and keeping one lance in his off lance bucket, and two in a double bucket on the near stirrup iron.

During drill movements of the Division the General generally kept his artillery quite in the background with the reserve. When the Division was working against a "marked enemy." the General in command of the Division and the Officer in command of the "marked Division" (who was always given a free hand) employed their artillery in entirely different ways. The former almost always kept his three batteries with the 2nd or 3rd line, and they often did not fire a shot until after the cavalry had charged. On the other hand, the Major commanding the "marked enemy," who had with him two guns, representing two batteries, almost invariably sent his artillery right ahead, with the 1st line or ahead of it, and opened fire with it as soon as there was anything to shoot at. Neither Commander ever divided his force of artillery.

Lieutenant-General Edler von der Planitz, commanding the Division, was

known to have strong views as to the employment of artillery with cavalry. He has published a pamphlet, in which he gives it as his opinion that, as the artillery is never likely to have an opportunity to fire more than two or three shots before its fire is masked, or it has to retire, it is not worth while to push it forward and run the risk of losing guns. I spoke to several Officers on the subject, and gathered that the general opinion was in favour of using artillery, as it was used by the Officer commanding the "marked enemy." Sometimes he pushed his batteries well ahead of his first line, but they were always withdrawn before they could be captured, and occasionally they were able to come into action before the enemy had deployed.

As regards cavalry charging artillery, it is laid down in the German Regulations that it should be done in two lines, the first line in single rank and opened out, and the second line at close files. I saw several charges of cavalry on guns, but in no case did it open out, and I only once saw a squadron in single rank. It seemed to me that not sufficient credit was given to the artillery. The General seemed always to decide that the artillery had the worst of it, however weakly or badly they might be attacked.

So far as I could discover, cavalry pioneers carried no tools, but only materials for blowing up bridges, &c. No materials or tools for building bridges are carried, but each squadron on the march from Berlin to Lüben had to construct a bridge. On the day before a river was reached an Officer was sent forward with some men, with orders to have a bridge ready next day. The Officer was allowed about 300 marks (15*l.*) and had to buy all materials on the spot, and get the necessary tools.

Each squadron on the march had with it a telegraph machine, carried on a led horse, with materials for connecting it with existing wires and tapping them. During the march communication was kept up with advanced squadrons by means of these machines and the ordinary civil wires. A certain number of Officers and men are taught telegraphy.

Visual signalling appeared to be unknown.

Each squadron has a Veterinary Surgeon, and there is sometimes a Chief Veterinary Surgeon in addition in a regiment. Generally, however, the senior squadron Veterinary Surgeon acts as regimental Veterinary Surgeon. This gives a proportion of about one Veterinary Surgeon to each 120 horses.

The dress in general seems suitable for active service in the field, except as regards the men's jack-boots, and the colour of the white cuirassiers and the red hussars. The white tunics of the cuirassiers caught the eye very much.

The jack-boots looked as if the men would have great difficulty in getting them on and off when wet, as they seemed to fit pretty closely all down the leg, but the Officers told me that they had never heard any complaints. The cuirassiers and the Gardes du Corps did not wear cuirasses. These are only worn now on rare parade occasions.

THE STORMING OF DOOBYÀN.[1]

Extracts from a review of "The Operations of the Batteries of the 1st Artillery Brigade of the Guard in the Turkish War, 1877-78."—(Khítrov). "Russian Artillery Journal," December, 1889.—Translated by Captain E. LAMBART, R.H.A.

N.B.—The headings are taken from the review in question, but only the paragraphs of the greatest interest are translated here, those omitted being mostly criticisms on the author's style and accuracy.

1. *The Object of the Fight of the Doobyàn Hills.*

WHEN Osman Pasha, the Commander of the Widdin force which was guarding Servia and Roumania, heard that the passage (of the Danube by the Russians) was accomplished, he marched out of Widdin with 30,000 men in order to fall on the right flank of the troops that had crossed, and to save Nikopolis. He did not succeed in this, but occupied in force Plevna, an important point, the richest of Cis-Balkan towns, amply supplied with stores, lying at the intersection of the river with the high road, surrounded by heights which lent themselves readily to the formation of advanced works. It seemed that Nature itself compelled the Turks to form here a fortified camp, whence they could keep in hand Servia, cut her off from Russia, and cover the splendid high road leading into the interior of Turkey, to Sophia, &c. Hence ensued the three affairs at Plevna, the 1st on the 8th July, the 2nd on the 18th July, and the third at the end of August.

* * * * * *

The Guard arrived, and it was decided to close the blockade of Plevna. This was interfered with by Little Plevna, *i.e.*, the fortified position of the Doobyàn Hill, lying between Plevna and Sophia, on the high road, 30 versts from the former and 120 from the latter. If you go from Plevna to Sophia by this road, you cross the River Vìd flowing into the Danube from the south, leave this river on your left, and successively arrive at the Doobyàn Valley, the Doobyàn Hill, Tellsàh, &c. (N.B. More correctly the Valley (adjective) Doobyàn and the Hilly Doobyàn—Doobyàn if a Russian word would mean a place of oak trees.—E. L.). The distance between the two Doobyàns is 6 versts, and from the Doobyàn Hill to Tellsàh is 8 versts. The River Vìd flows out of the Balkans almost due north and south, and almost parallel to the Sophia road, at first leaving the latter on its left, and gradually approaching it. At Tellsàh the river is 10 versts from the road, at V. Doobyàn[2] 6 versts, and at H. Doobyàn[3] 5 versts. After that, not far from Plevna, the Vìd crosses the high road, leaves it on the right, and gradually receding from it flows into the Danube near Nikopolis. The Vìd is easily fordable in many places, the fords being stony with water knee-deep.

Four batteries of the 1st brigade, with three regiments of the 1st Division,

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[1] No plan is given in the original. The accompanying sketch is adapted from "La Guerre d'Orient," but does not altogether correspond to the description of the redoubt given in this article.—L. A. H.

[2] Valley.

[3] Hilly.

were told off to serve as a screen from the side of Plevna. One battery of the 1st brigade took part in the demonstration against Tellssh. The remaining (6th) battery of the 1st brigade was told off to prepare the assault on the H. Doobyàn. All the field artillery of the Guard was armed with the same calibre, viz., 9-pounders. Three columns were told off for the capture of H. Doobyàn, the right column, consisting of the Guard rifles and two (6th of the 1st and 6th of the 2nd brigade) batteries, were to attack Doobyàn along the road, and afterwards from the side of Plevna. We shall concern ourselves exclusively with this column, as the preparation of the assault by the batteries of the 1st brigade enters into it. The column comprised four battalions, sixteen guns, two squadrons, and a sotnia of Cossacks. The centre column (Guard and Moscow troops) with two (1st and 2nd) batteries of the 2nd brigade was told off to attack *across* the high road. Lastly, the 3rd column (Paulovski and Finland regiments), with two (3rd and 4th) batteries of the 2nd brigade, was told to attack along the high road, and then from the side of Tellssh.

All the batteries (five), except the 3rd, took part in the preparation of the attack; the 3rd battery was at that time at Plevna. We shall not follow all these batteries, but only the 6th, which formed part of the right column, and acted in line with the 6th battery of the 1st brigade along the road from the side of Plevna.

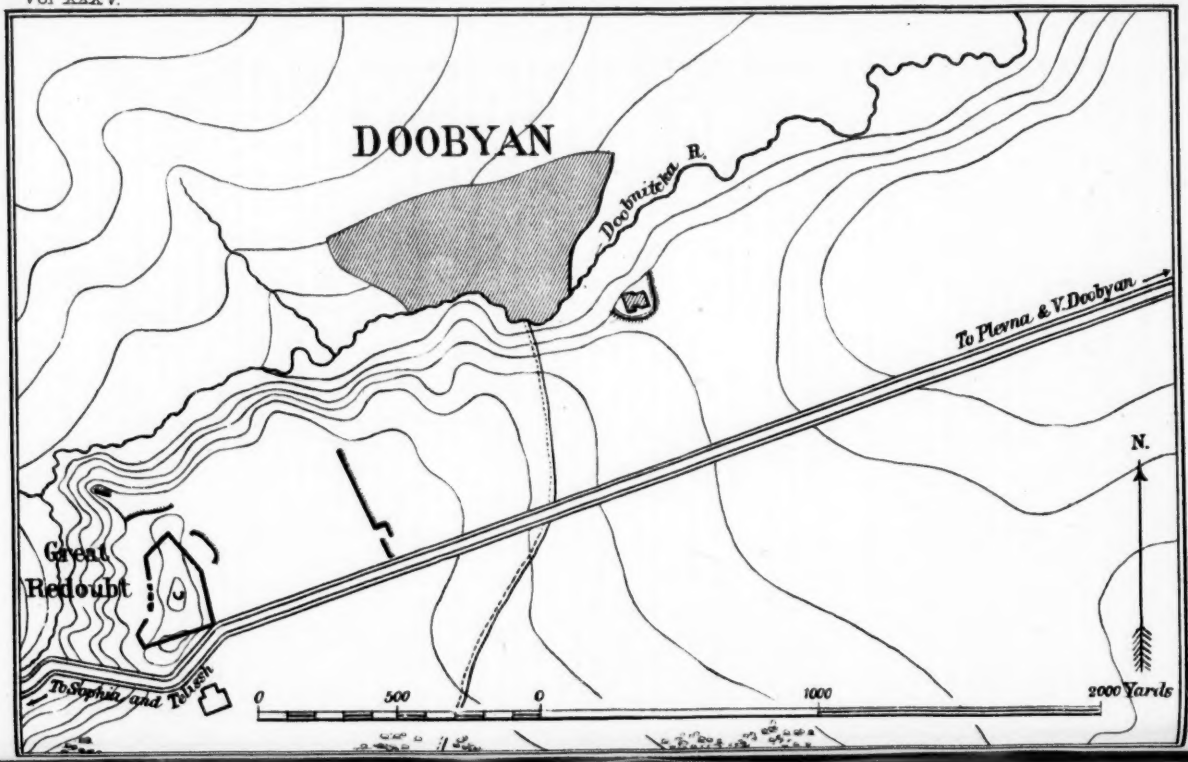
The Night before the Attack.—The 6/1st battery had several days' rest between its march and the battle, but its companion and neighbour, the 6/2nd battery, was in worse circumstances; after a march of 800 versts, finishing with a march of 25 versts, it only arrived in bivouac at 8 P.M., and not having had time to feed either men or horses, was immediately moved to Doobyàn. "The night was cold and starlight; the men, in anticipation of a night movement, did not lie down. A strange sort of stillness settled on the bivouac. It seemed as if all were penetrated by the feeling of the last solemn hours of rest before the beginning of an exhausting, tremendous day. The regimental Chaplains calmly prepared for Divine Service. In exact accordance with the orders for the troops of the Guard and the cavalry of the reserve, punctually at midnight a force moved off (under the command of Major-General Ellis (senior)), consisting of the rifle brigade of the Guard, 6/2nd Guard battery, 6/1st Guard battery, 1 sotnia of No. 9 Don Cossack Regiment, and 2 squadrons Kuban cavalry (of His Majesty's Own Body Guard)."[1]

The author constantly refers in detail to all that concerns the 1st brigade (*i.e.*, battery), and only passingly and lightly mentions other details. We think such treatment of the subject perfectly right, and worthy of imitation. We could wish that all military diarists did the same. Thus, for instance, the author rarely mentions by name the Officers of the other units, and on the other hand enumerates all the Officers of the 1st brigade battery. "The columns proceeded through the villages of Yeni Barkatch and Chìrikov. Crossing the Vìd at a ford marked out by a buoy, the force drew up in reserve order[2] between the Vìd and the crest of the rising ground left of the stream on the road from Chìrikov to Krooshevìtz, 2 versts from the former. Here, in a deep valley completely hidden, the troops passed some hours in solemn oppressive expectation."

The Morning of the Battle.—"At 6 A.M. the troops were ordered to roll cloaks and put them on *en banderole*. At 6.15 A.M. they again moved off. The Cossacks and Kubans followed, partly in scouting formation. The rifles marched in (line of ?) close columns, the 1st and 2nd battalions in front, the

[1] Title of regiment, I think.

[2] Corresponds, I think, to our line of quarter columns, or rendezvous formation.


DOOBYAN
Doobnitsa R.
To Plevna & V.Doobyan
N.
Great Redoubt
To Sophia and Telish
0
500
0
1000
2000 Yards

3rd and 4th in rear. The batteries followed the infantry columns. The movement was slow, owing to there being no road across the sweet-smelling fields, sometimes through maize which completely hid the column. Throughout the detachment a cheerful impatience made itself felt. Everywhere was heard the order 'March quicker.' The artillery did not lag behind the infantry. The greatest attention was paid to keeping silence, which was rendered necessary to conceal a movement in close proximity to the enemy. In connection with this it was necessary continually to caution the drivers, who, in consequence of their deeply rooted habit of urging on their horses, could not move without shouts. About 8 A.M. the advanced cavalry came in contact with enemy; in front and on the left were heard a few single shots. The sun was already shining hotly in a cloudless sky, and after the cold night it was a lovely clear day. The firing became more frequent."

The Beginning of the Attack.—"Everybody seemed to feel the solemnity of these moments. Many reverently crossed themselves. The ground in front was hidden by the intervening irregularities; nevertheless, it was clear that the column was near the high road, and consequently had arrived at the point from which the attack on H. Doobyàn was to be delivered. The General Commanding ordered the battalions to throw up their right shoulder, which brought the 1st and 3rd battalions into the front line, and the 4th into the 2nd line. Dressing with them, the two batteries moved forward in double column of sections from the centre. Before the turning movement was completed, the 2nd battalion of the rifles was called out and ordered to direct its front on V. Doobyàn, in order to secure the rear of the column directing itself against H. Doobyàn. After throwing up their right shoulders, the battalions formed company columns, with skirmishers in front, not halting for a moment. About 8.30 the column began its advance on H. Doobyàn."

The Advance of the 6/2nd Battery to the Fighting Line.—The 6/2nd battery advanced into one of the intervals of the company columns, took up its position at 1,200 sajens (2,800 yards) from the enemy, and opened fire with common shell; the 6/1 battery remained in reserve. In order to give time to draw closer the line of battle the troops in reserve halted, but only for a few minutes. The order was shortly given to the rifles, with four guns, to move to the right. The 2nd half-battery, under Staff Captain Miller, remained behind, and the other half-battery accompanied the rifles. The firing was already heard in the left column. The enemy answered at first with a few shots, but then quickly followed a quick and strongly developed fire against the left column from the enemy's redoubt, which showed itself directly in front 2½ versts away.

Description of the Turkish Redoubts.

The Great Redoubt was so placed that its front commanded the Plevna-Sophia high road, *i.e.*, the direction by which the column under General Ellis was to advance. The redoubt was placed on the top of the hill, by which the road rises from H. Doobyàn to Tellish—this rise continues for a whole verst—the portion of the road from Plevna to this hill goes in a perfectly straight line almost to the top of the hill, and only at the very top makes a slight turn to the left; this turn is about 350 yards long; after that the road again descends the hill almost in a straight line. Looking from the top of the hill, in the direction of Doobyàn, on the left we see the streamlet Doobnitchka or Kladenetz, flowing into the Vid, and on the right, and in front of the high road, the road and the streamlet run almost parallel to each other, the distance between them is about half a verst—the hill rises about 63 feet above the stream; the left side of the hill and redoubt are protected

by this streamlet, which flows in a pretty deep ravine; behind the hill, and consequently in rear of the redoubt, a rivulet flows in a deep ravine, and falls into the Doobnitchka at the end of the hill, almost at right angles. Thus the ascent to the hill from the rear is hindered by the rivulet, and from the left by the Doobnitchka. From the front towards the road the hill presents a smooth slope for a whole verst, not a tree nor a shrub on it. After this slope at the foot of the hill the ground again rises; the slope is rather steep, but this hill is not so high as the one on which stands the redoubt. On this second hill, from the same side of the road as the Great Redoubt, rises a hillock or knoll. This marks the first position of our guns. From the right side of the redoubt hill the ground slopes more sharply than from the front, but not so abruptly as on the left and in rear. Here on the right side the surface is undulating, and beginning at 500 paces from the entrenchments, is sown with bushes and young oaks.

The Great Redoubt was built for three "tents,"[1] and the whole Turkish force occuping H. Doobyàn included about 4,000 Nizams, 500 Bashi-Bazooks, and 4 steel guns, with about 50 artillerymen. About 2,500 men, in single rank, might find place on the firing line of the redoubt; but the greater portion of the fortifications were defended by troops two deep. The front face of the redoubt commanded the high road and the sloping ground at its side, and this command was strengthened by two lodgments for skirmishers, thrown forward for half a verst, each capable of holding two companies. The left face commanded, first, the approaches to the redoubt from the side of H. Doobyàn, and secondly, further on, the valley of the Doobnitchka; in front of this face, at a very short distance, 130 yards, was a small lodgment, which was probably meant to serve as a reserve to the two above mentioned. To the face of the redoubt, which was perpendicular to the road, there joined on from the right side, at the right angle, a long face, going along the road, with a turn corresponding to the turn made by the road, and this turn commanded the whole length of the road, and served besides as a covered communication from the redoubt to the road. In front of the right extremity of the right face on the *other* side of the road, was a small closed lunette, and it was generally known as the Small Redoubt. Inside the Great Redoubt, at the very top of the hill, was built a "cavalier" for guns, and here, no doubt, the two guns were placed.

The profile of the front face of the redoubt was as follows:—The breastwork was 4 feet high and 10½ feet thick; the exterior and interior slopes were both revetted with thorns, and almost perpendicular; the front ditch, nearly triangular, was about 7 feet deep and 11 feet wide at the top; a broad banquette inside, with an interior ditch, and behind, again, a rear breastwork, acting as a traverse from reverse fire (parados), and especially against splinters—from this breastwork a second line of fire was brought to bear—behind the breastwork was yet another ditch, covered with thin planking, which served as a shelter from rain.

The Firing of the Batteries from the Position at the Hillock.—Range about 1,980 yards. The fire continued about an hour, from 9 to 10. In the midst of the crackle of musketry was heard the rapid fire of the guns against the principal fortification of the enemy, marked out clearly by its high sharply-defined "cavalier." On the line of attack of the Rifle Brigade rose a knoll, rising up on the top of a hill, commanding all the surrounding ground. The position for the artillery was chosen on this hill. Hither were summoned in turn by half batteries the 1st half batteries of the 6/2nd battery and the 6/1st battery, the other half battery of the 6/2nd received orders to move out to the left, and occupied a separate position. The 1st

[1] This seems to be a Turkish expression for a certain body of men.

half battery 6/2nd moved out first and occupied the knoll itself. . . . . (Reviewer's note.) In the text of the book under review occurs a small misprint, which makes it impossible to understand how the two half batteries of the 6/1st were placed—which was on the right of the knoll and which on the left. Judging by the map we think that not the whole half battery 6/2nd found place on the knoll—there could only have been room for one gun there—at most for two. Besides, Prince Shakhovski, an eye-witness, in his book "Two Campaigns in the Balkans," also says, "the battery on the knoll." This knoll is sketched from Nature in Baron Kaulbars' book. Judging from the sketch there could only have been room for one gun on the knoll. "Thus was formed a 12-gun battery, having in the centre four guns, raised on the knoll." The half batteries advanced in line at a trot, which was much assisted by the smooth and even surface. All the guns drew up at full interval, except the four on the knoll, which were obliged to close together. The position was an ideal one—the knoll in the centre affording an excellent point of observation. Before it spread out an open even field, descending slightly, and then ascending to the redoubt. From the crest of the "cavalier," rising high over the redoubt, burst out at times puffs of powder smoke. The crest of the breastwork was hidden by a thick whitish haze, which marked the line of the enemy's rifle fire. Only short intervals of time occurred between the successive movements into position of the half batteries, but the range was already determined as about 1,900 yards, when the 6/1st battery came into action. Having ascertained the elevation from the half battery already there, the 6/1st battery opened fire with shell. Two successive shots verified the range, and the whole twelve guns continued a rapid shrapnel fire. The enemy's fire, which seemed very strong, during the advance of the batteries, to the general astonishment, caused no damage—one hussar of the escort and a few horses being wounded only.

The Order to the Batteries to Move Closer to the Redoubt—the advance of the 6/2nd Battery—the Death of Podgaetzki—the Advance of the Half Battalion of 6/1st.—Soon after this, when the batteries began to fire shrapnel, the Turks rushed out of their advanced trenches. A few of our Officers thought this meant a general retreat of the Turks, and thought of sending for the cavalry to pursue them; it soon appeared, however, that the Turks were only running into their redoubts. When this was seen, the batteries were ordered to advance. The Turkish guns were at this time hardly silenced; they were still firing. Our infantry escort could, with difficulty, go to the support of those of our guns which had moved first to the nearer position "The guns quickly limbered up, and galloped to the front," writes Prince Shakhovski; the Turkish cavalry, Bashi-Bazooks, showed themselves on the left flank of the position and had begun to form up to attack the batteries; the Turkish riflemen, as our batteries advanced, no longer fired almost at random behind the breastwork, they fired with more careful aim. Thus our batteries, and especially those which moved nearer first, performed a truly heroic deed. On a perfectly bare place, without cover, having against them cavalry on the right flank, preparing to attack them, and in front the artillery of the redoubt, covered by a breastwork, and a double banked fire of Martinis from the infantry, our batteries boldly galloped to a distance of 700 yards from the Great Redoubt. In the course of this one of the two battery Commanders, Colonel Semenov, was wounded. One of the four half battery Commanders, Staff Captain Podgaetzki, was killed. Sub-Lieutenant Sergpootovski succeeded to the command of the half battery, and his horse was immediately wounded under him; one of the batteries lost, in a few minutes, almost one-third of the rank and file in killed and wounded—the other battery nearly one-fourth. And no wonder! At 700 yards every single man was clearly visible. Our battery lost sixteen horses, the other fifteen.

A great supply of mental obstinacy and pride was needed to remain in position under such a fire; but the batteries held on. Harder than all was it for the four guns that arrived first. The Turks fired at them with common, with shrapnel, with case, and, worst of all, with a well-aimed rifle fire. But the half battery was victorious, compelled the riflemen to take cover, to betake themselves to an unaimed, random, useless fire, and shattered the Bashi-Bazooks.

The second half battery of 6/2nd, under the command of Staff Captain Podgaetzki, fired at the commencement of the fight at the same distance from the redoubt as the other twelve guns, but was placed, not on the hillock, but to the left, nearer the high road; it hastened to the second position at the same time as its other half battery, but had hardly traversed half a verst when Podgaetzki was killed on the spot—shot by a bullet in the heart. He suddenly cried out, struck his breast twice, and fell from his horse. Two gunners at once ran to him, and in a weak voice he said "Water." In half-a-minute this was brought, but he was already dead. Sub-Lieutenant Serjpootovski took over the command of the half battery. The half battery acted independently for some time on this nearer position, but afterwards formed up on the right of its other half battery.

Let us pass on to the description of the advance of the half batteries of 6/2nd. The 1st half battery moved first.

"The Commander of the 1st half battery 6/1st battery, Captain Andreganov, in accordance with the orders he received, led forward his half battery before the half battery of 6/2nd had commenced operations in the new positions. He moved at a sharp trot unnoticed as he quickly descended into the valley by the sloping surface of the broad open field spreading out in front of the redoubt. The smooth ground allowed the preservation of a regular formation. Soon the redoubt with its "cavalier" was concealed from view. What was Captain Andreganov to anticipate? From the moment of the disappearance of the redoubt, as he continued his advance, he every moment drew nearer to the enemy's position without seeing it. When and at what distance from the redoubt he would have to halt was unknown to him. It might be that the redoubt would only show itself to the half battery at case-shot range. In order to gain the time necessary to investigate the ground in front, Captain A. might delay his advance, profiting by his being screened from view of the enemy. Not losing a moment, he did this. The commands followed—"Walk," and "Nos. 1 to the front." The latter galloped forward from behind the Captain. Passing the valley they began to ascend the rising ground leading straight to the redoubt. First the "cavalier" and then the redoubt showed themselves at 700 yards. It was time to halt. . . . . The advance was effected without loss. More to the right the half battery 6/2nd was already in action."

The Leaden Hail.—"There burst on the battery a leaden hail. Having fired only ten common shell, Captain A. commenced with shrapnel. In spite of this the enemy's fire did not diminish nor slacken for an instant. The ceaseless whistle of bullets seemed the production of some infernal machine. The involuntary emotion of the men showed itself by increased activity. A nervous haste showed itself everywhere. The numbers bringing up the ammunition, in defiance of the regulations, did not walk, but ran. And it was impossible to help running, for the limbers were placed so far behind the crest of the slope that it was soon necessary to change the wearied Nos. 5" (I don't see the logic!—E. L.).

The Valley of Death: the Advance of the Second Half Battery of 6/1st to the New Position.—"Thus the exposed battery stood in front of the concealed enemy at 700 yards, striking them with shrapnel fire, and, in its turn, suffering from a fire of extraordinary intensity. It seemed as if the moments of

the battery's existence were numbered, that its last hour had come; BUT ten minutes passed and the battery not only existed but was destroying the enemy with immunity, and only after the 25th round did the first casualty occur. At the 2nd gun the No. 2, Bombardier Romanov, fell mortally wounded in the breast. The leaden hail passed over the struggling half battery, striking somewhere behind. But the deadly zone must be somewhere. It was to be found 700 yards in rear of the battery. Here was a strip of ground 620 yards broad that consumed every living thing that stood on it.

"Across this zone had now to advance the 2nd half battery of 6/1st in order to join Andreganov's half batteries * * *. This half battery * * * successfully crossed * * * the valley of death."[1]

The Fire of the Batteries from the Closer Positions—the Artillery Duel—the Fight with Cavalry—the Fight with Infantry.—The range was about 700 yards. The fire continued about two hours, viz., from 10 till 12. From the position of the guns it was difficult to determine not only where the Turkish guns were but how many they were, for the "fezzes" continually moved them from place to place. But soon the huts of the redoubt began to smoulder, the stacks of barley burst into flames, then suddenly rose a thick black clump of smoke—a limber box had blown up. The "fezzes" became silent.

The Bashi-Bazooks who were beginning to draw up for attack on the right flank of the half battery were, happily, noticed in time, and dispersed with shrapnel—the squadron did not advance. The riders tumbled one over the other "like a house of cards." In some of the men and horses were found (afterwards) dozens of shrapnel bullets. A few days after the battle the ditches of the redoubt were still full of dead bodies, and the Turks taken prisoners were ordered to drag them by the heels to the prepared places for interment. Besides this some of the dead and wounded were burnt in the conflagration (of the huts, stacks, &c.).

The riflemen (Uigams) at first opened a murderous fire on the half battery, but were quickly compelled to hide their red fezzes behind the breastwork, whence, sitting on their haunches, they fired at random into the valley of death.

One after the other, three other half batteries formed up and a battery of sixteen guns was formed. Soon Colonel Semenov was wounded. . . . All of a sudden a new misfortune fell on the batteries—common shell began to burst on the position.

"The time passed, but the circumstances did not change. That fearful fire directed on the battery without ceasing for a moment continued to cause casualties in the ranks. The batteries, having approached close to the enemy, were, as it were, isolated from their surroundings. The field of battle everywhere else seemed dead—nowhere was any movement to be seen—the infantry fight ceased on both sides, and the artillery alone continued to act, drawing on itself this cruel rifle fire. Thus passed nearly two hours. The batteries fired away a large portion of their ammunition (five limber boxes besides that expended on the first position), and the Commanding Officer ordered the fire to be relaxed, and the common shell remaining in the boxes to be used, as well as the shrapnel. Suddenly, through the hum of rifle bullets, was heard the roar of an artillery projectile, and a shell burst between the limbers and the guns.

"Some twenty shells burst round the batteries but did no harm. From the very beginning of the battle the enemy's artillery fire had ceased to be effective and had been treated as non-existent, and, therefore, the unexpected reappearance of artillery fire directed against the battery was unintelligible."

[1] N.B.—The asterisks are unfortunately in the original.—E. L.

The Cessation of Fire.—"It was about 12 o'clock when on Officer rode up to the battery bringing the order to cease firing altogether, but to remain in the position. As soon as the batteries ceased firing the redoubt also ceased. All was still. . . . In No. 6 gun from the rapid fire a leakage of powder gas showed itself. Bombardier Kolesnikov went up to his gun, quietly cleaned the lock, put in a new washer (to the breech block), and did all this under a heavy rifle fire directed solely at himself. The batteries remained inactive about an hour.

"As some of the guns were loaded with shrapnel, and they feared to remain with loaded guns after the final cessation of fire, the battery commanders decided to fire these guns. The detachments were called up and slow firing opened, and, at the same moment, a leaden hail opened from the redoubt, ceasing as soon as the gunners took refuge again behind the bank. This operation took only a few moments, but was not carried out without loss—Bombardier Selikhov was wounded in the stomach. This time the enemy's bullets flew much lower, seemingly just over head; the deadly zone was probably somewhere not far off, but the slope up from the battery to the redoubt saved the battery."

Hence it seems that when the Turks came to themselves a little, after a respite from the hail of our batteries, they immediately began to take some aim, and the dangerous zone began to approach the object. But if our batteries again renewed the battle, the Turks again squatted on their haunches and fired at random.

About 1 o'clock Generals Gourko and Brever rode up to the batteries. The order was given to return with all the guns to the position on the hillock. The Turks were filled with delight, and, although they fired a little on the batteries, the fire noticeably slackened.

The Episode of the Nine Salvoes.—"In the meantime General Gourko made a final attempt to gain possession of the enemy's entrenchments. With this object the order was given for a simultaneous attack after nine salvoes from the artillery. These were to serve as a general signal. Three batteries were to give the salvoes, in this order: the battery of General Rosenbach's force, I; that of General Zeddler, II; and that of General Ellis, III; each to fire three salvoes."

We are reminded in connection with this of Sovvorov's arrangements at the storming of Ismail: the troops approached by night under cover to 700 yards from the fortress: at 3 A.M. a rocket was fired as a signal to take their places; at 4 A.M., another, for the troops to form up; at 5 A.M., a third, the columns moved off. We emphasize the *three* rockets, *not* nine. Three rockets, *not* salvoes. A rocket in the stillness of night is a signal at once visual and acoustic, catching eye and ear both. And *yet?* The signal given by the last rocket *was not noticed:* Major Keklooder came to the leader of the column, and, looking at his watch, said, "Shall we start?" "In God's name," answered Lassy . . . .

On the position at the hillock stood the two batteries 6/1st and 6/2nd, in all, 16 guns. The senior Officer was the Commander of the 6/2nd, who had received from Ellis (senior) the order to fire three salvoes after the six salvoes fired by the batteries of the other columns. Soon from the right flank was heard a distant roar. Was this a salvo or the bursting of artillery projectiles? Was this one of the salvoes agreed on or only the result of something happening unexpectedly? All were silent in dumb anticipation, and suddenly, instead of a repetition of the signal from the right, a salvo was clearly heard from the left, and after that all was in confusion. From both sides sounded artillery salvoes, and along the whole line the crackle of musketry increased, with an answering burst of fire from the redoubt. Completely out in his reckoning, and fearing to be behindhand, the Commander of

6/2nd was obliged to fire his three salvoes. After that all was confusion.

The Capture of Doobyàn—the Night after the Battle—the Capture of Telissh by Artillery Fire alone—Retreat of the Enemy from V. Doobyàn.—The reviewer apologizes for not referring to the chapters under the above headings on account of want of space, and the review practically ends here, the remaining paragraphs only containing an account of the death of one of the Officers, and lavish praise of the author.

NOTICES OF BOOKS.

Fortification: its Past Achievements and Future Progress. By Major G. Sydenham Clarke, C.M.G., Royal Engineers. London: John Murray, 1890. Pp. 310. Size 9½″ × 6½″ × 1¼″. Weight under 2 lbs. 2 oz. Price 21*s.*

Whilst very glad to bring this work, on account of its merits, to the notice of the readers of the Journal, it is necessary to warn them that it is more or less of a distinctly controversial character. The aims of the author are apparently four in number, and we place them in the order in which they make their appearance in the book. First, to discredit permanent fortifications of the past; secondly, to reform the teaching of permanent fortification; thirdly, to put the permanent fortification of the present on the basis he considers sound; fourthly, to explain the principles which should govern coast defence, that branch of the subject of the greater interest to citizens of the British Empire. As regards the first object, the discrediting the value of permanent fortification in the past, the author draws extensively on military history; but how far fortresses in past ages fulfilled the purposes for which they were originally built is a very big subject; and as Major Clarke warns us himself of the liability of drawing erroneous deductions from the facts of military history, we could not pronounce any opinion on the value of the author's own deductions until we had fully examined into each case he utilizes for his argument, a study for which we have no time to spare. As instances of the necessity for independent inquiry, we may quote first the siege of Tournay, in 1704, the duration of which Major Clarke gives as twenty-eight days only; Muller, a German writer, gives it as fifty-seven. The discrepancy is, we believe, due to the fact that the latter writer includes the duration of the resistance of the citadel, and the former omits it. Similarly, Major Clarke writes of Belfort as follows: "Belfort on the front attacked thus presents the case of a stupendous enceinte protected by provisional works. The latter answered their purpose remarkably well; the former *quâ* enceinte proved absolutely worthless as soon as the provisional works had fallen. The utter futility of an enceinte as a practical retrenchment is well illustrated by the case of Belfort. Here was an enceinte on Vauban's third system, a veritable triumph of the draughtsman's art, defended by two rough and ready redoubts, Les Perches. The fall of the latter involved the surrender of Belfort." Now, what were the actual facts of the case? On the 8th February, Les Perches were abandoned by the French, and fell into the hands of the besiegers. On the 13th. Colonel Denfert, the Commandant of Belfort, is summoned to surrender. Shortly after, we are told in the German official account, the French Government itself empowered him to take this step, by means of a telegram sent through Count v. Bismarck to the Commander of the besieging force. But the brave General has no idea of surrendering at present: he requires a summons from the Government addressed to himself personally, and to seek this an Officer was sent to Basle, and meanwhile a provisional suspension of arms was agreed upon. On the 15th the Convention was signed at Versailles, which extended the armistice of the 29th January to the three Departments which had been hitherto exempted therefrom, and to Belfort. Article 1 stipulated the surrender of the fortress. "Colonel Denfert *having now received his instructions in the desired form*, the final nego-

tiations commenced on the evening of the 15th, and terminated the following afternoon." The war was over; what earthly motive was there for Colonel Denfert to attempt to hold the enceinte absolutely against the directions of his own Government? And Belfort is quoted as a decisive instance of the uselessness of an enceinte. With these two remarkable readings of military history, we cannot possibly accept the other deductions of the author without close examination of the cases he brings forward. So much for the historical portion of the work, of which it seems to be a sort of foundation.

As regards Major Clarke's assaults and thrusts on the teaching and study of permanent fortifications by the cadets of to-day, we thoroughly concur in his view, that it is in need of radical reform. Tactics have not even yet got clear of the era of Austerlitz and Waterloo; a detailed knowledge of these is even supposed in some quarters to be of value beyond that of an antiquary kind; and is supposed to enlighten Officers in the practical soldiery of the magazine rifle; and fortification is still in the choking grip of the past.

With respect to the method in which fortresses should be defended in future, the author is fully entitled to his own opinion, which seems to be that it should be a tactical defence in which the principal factor is "steady troops, covered by a parapet, protected by an obstacle under its fire, and amply supplied with ammunition." In fact, Major Clarke regards the defence of a fortress as similar to that of a position. "Redoubts designed for infantry and machine-guns, supported by a powerful artillery kept outside of them, and supplemented by a field force carrying on the outpost duties, and manning field defences guarding the intervals." This again is open to question.

In the latter half of the book, Major Clarke hints of coast defence, and puts it forward in a manner which renders the subject very interesting. We should not have noticed this work at this length were we not sure that it would be read by many who are not professional engineers or artillerists, and it therefore seemed desirable to warn them of its controversial character. The actual practice of English engineers is as given in a recently published volume of the Royal Engineer Institute Papers, written by Major Lewis, R.E., a semi-official and thoroughly technical publication. Major Clarke's work is more of a popular treatise, though full of professional knowledge. Both authors are on the staff of the Inspector-General of Fortifications and Engineers. We think that to experts must be left the decision of the marked differences of opinion between them.

Studio sulle Bussole della nostra Marina da Guerra. From the "Rivista Marittima" for September, 1890. Published in form of a Pamphlet.

In the above paper Commander Aubrey, of the Italian Royal Navy, gives a description of the compass adopted in that Service, and also of the system of correctors employed for obviating the disturbing effects of the iron in the ship, his remarks being accompanied by diagrams, and the magnetic history of two or three iron ships.

The author does not claim any special novelty, either for his description or diagrams, as they have been to a large extent previously published in the "Rivista Marittima" for 1883. He has, however, brought them before the public again, in order to lend point to certain conclusions he has formed with regard to the system of correctors adopted in the British Navy.

In January of this year an abridgment of the paper entitled "The Mariner's Compass in Modern Ships of War," from No. 150 of the Journal of the R.U.S. Institution, vol. xxxiii, 1889, was published in the "Rivista Marittima." This abridgment appears to have been read by Commander Aubrey, and he has unfortunately received certain impressions therefrom, which he could hardly have done had he read the paper in its entirety.

Turning to the volume of the "R.U.S.I. Journal" quoted above, at page 961, it will be found, in reference to Her Majesty's ship "Orlando," "at the bridge compass the quadrantal deviation is only about 5°, and can be readily corrected by a pair of 7″ spheres, which also help to correct about 44′ of heeling error for every degree of heel on the north and south points till the first 5° of heel are reached." Now it

is worthy of special note that the corrections here mentioned remain exact for all navigable portions of the world, and further, had the quadrantal deviation been 10°, it could have been corrected equally well, and once for all latitudes with a corresponding correction of the heeling error.

It is evident from these considerations that the spheres do their work of correction entirely independently of any induction from the compass needles, and that in the ordinary positions of compasses used in navigating the ship the use of fixed spheres is entirely satisfactory.

But the problem to be solved was how, in thickly armour-plated conning towers, and other protected places where the quadrantal deviation ranged between 16° and 30°, was the correction to be made perfect in all latitudes with spheres of manageable size? And, equally important, how was the mean directive force observed, varying between 0·6 and 0·2 of the earth's horizontal force, to be increased? It was evident that space and general convenience would not allow of spheres, varying from 16 to 24 inches in diameter, being used, and the mean directive force would by their means be but slightly improved.

The fixed spheres for such positions were then given up by the author of the paper, and the Priehl quadrantal corrector, so long used in the Austrian Navy, which enables an Officer to correct 28° of quadrantal deviation, whilst restoring the mean directive force some 20 per cent., was recommended for such abnormal positions. The defects in the Priehl quadrantal corrector are (1) it requires readjustment on any great change of the earth's horizontal force, and (2) the heeling magnet must be frequently readjusted; (3) the soft iron correcting rods gimbal with the compass, and do nothing towards correcting the heeling error.

The liquid compass of the Italian Navy appears to be a valuable instrument, and to give general satisfaction in that Service. The method, however, of applying Airy's system of correction by magnets and soft iron is certainly open to criticism. Thus, the disturbing magnetic forces of an iron or steel ship are considered to act in certain fixed directions fore and aft, athwartships, and vertically upwards or downwards. Is it not therefore more correct to place the correctors so as to act in fixed and opposite directions to those disturbing forces, than to attach them to a sort of pendulum in constant motion as the ship rolls or pitches? With the magnets, perhaps, little is lost by such an arrangement, but with the soft iron correctors it is different.

In the Italian system, the soft iron correctors are attached to the compass bowl, and gimbal with it. No doubt large quadrantal deviations can thus be corrected for any given value of the earth's horizontal force, as the powerful needles of the liquid compass employed induce opposite polarity in the soft iron correctors, but for standard compasses and those in the usual positions for navigating the ship, two valuable properties possessed by the fixed spheres are lost.

These properties so lost are (1) the correction of the quadrantal deviation once for all in all latitudes, and the correction of that part of the heeling error proceeding from vertical induction in transverse iron.

For example: Let a ship at Portsmouth be fitted with two compasses, a Sir W. Thomson's 10″ compass, and a standard liquid compass of the Italian Navy. Next suppose the quadrantal deviation at both compasses to be 8°, and the heeling error from vertical induction in transverse iron to be 50′ for each degree of heel. Correct the Thomson compass exactly by fixed spheres only, and the Italian compass exactly by the soft iron correctors attached to the bowl, adding the necessary vertical magnet to correct the heeling error. On the arrival of the ship at Bombay, where the earth's horizontal force is 2. as compared with its value 1, at Portsmouth, the result will be very nearly as follows:—The correction of the Thomson compass will still be exact. The Italian compass will have some 3° or 4° of quadrantal deviation to correct, and the heeling magnet will require readjustment.

In the comparatively limited change of terrestrial magnetic elements, horizontal force and dip, in the Mediterranean, the Italian ships would not be much troubled with the points just discussed; but for the British Navy, which has to traverse such a wide range of horizontal force and dip in all parts of the world, the absolute correction of the quadrantal deviation and one important part of the heeling error for all latitudes are of great value. By the British system of correction these objects are practically obtained.

Scenes through the Battle Smoke. By the Rev. ARTHUR MALE. London: Dean and Son. Pp. 482. Size 8″ × 6″ × 1¾″. Weight under 2¼ lbs. Price 10*s.* 6*d.*

Mr. Male was a Chaplain to the Forces with Sir Sam Browne's force in Afghanistan, and was also in Egypt with Sir Garnet Wolseley's Expedition.

Rulers of India. Edited by Sir W. W. HUNTER, K.C.S.I. Oxford: The Clarendon Press, 1890.

This series of useful works, already noticed in the Journal, has been further increased by the following:—

Warren Hastings. By Captain L. J. Trotter.
Dupleix. By Colonel Malleson.
Akbar. By Colonel Malleson.
The Marquess Cornwallis. By W. S. Seton-Karr.

The price of each work is 2*s.* 6*d.*

Manual of Field, Siege, and Garrison Artillery. Compiled by S. MILLS, Staff Sergeant and Gunnery Instructor, Royal Marine Artillery. Portsmouth: Chamberlain, 1890. Price 1*s.*

A Guide to Hindustání. By G. S. A. RANKING, Surgeon-Major, Bengal Medical Service. Calcutta: Thacker, Spink, and Co., 1889. Pp. 130. Size 8½″ × 5″ × ½″. Weight under 10 oz. Price 7*s.* 6*d.*

This work is specially designed for the use of Officers and men serving in India with reference to the requirements of the Government of India, as laid down in Clause 129, Army Circular of August, 1888.

Sir Richard Church, C.B., G.C.H., Commander-in-Chief of the Greeks in the War of Independence. By STANLEY LANE-POOLE. London: Longmans, 1891. Pp. 75. Size 9″ × 5¾″ × ¼″. Weight under 14 oz. Price 5*s.*

This sketch of the military adventures of General Sir R. Church is reprinted from the "English Historical Review."

The War in the Crimea. By General Sir EDWARD HAMLEY, K.C.B. London: Seeley and Co., 1891. Pp. 307. Size 8″ × 5½″ × 1¼″. Weight under 1½ lbs. Price 5*s.*

The size of this work is so small compared to the subject, that some of those who read these notices might imagine the subject of this one to be of the essay character. It seems desirable to say, therefore, that the book is a narrative of the Crimean War, somewhat in a condensed form, but therefore perhaps all the more attractive. As the author is so well known, and is about the fittest soldier and writer to act as historian of the campaign, it seems only necessary for us to notify to the readers of the Journal the publication of the book, and to abstain from any comment upon it.

Epochs of the British Army. By Lieutenant-Colonel H. S. SPALDING. Illustrated by R. SIMEIN. London: Allen, 1891. Pp. 52. Weight under 10 oz. Price 1*s.*

Colonel Spalding gives a brief summary of the exploits of the British Army during the following epochs:—The Commonwealth, the Restoration, the Revolution, the Epoch of Marlborough, the Georgian Epoch, the Peninsular Epoch, the Crimean Epoch, the Egyptian Epoch. Why in the Victorian Epoch only the Crimea and Egypt should find a place we cannot tell.

Lettre sur la Marine à la Commission du Budget. Par E. WEYL. Plon, Paris: 1890. Pamp. Pp. 50.

A defence of French naval administration against the report of the Members of the Commission of the Budget.

Architecture Navale. Théorie du Navire, par J. POLLARD et A. DUDEBONT, Ingénieurs de la Marine, Professeurs à l'Ecole du Génie Maritime. Tome 1. Calcul des Éléments Géométriques des Carènes droites et inclinées. Géométrie du Navire. Paris: Gauthier-Villars, 1890. Pp. 354. Size 10″ × 6¼″ × 1″. Weight under 2 lbs. Price 13 francs.

This is a very scientific and erudite work.

Nautical Surveying. By the late Vice-Admiral SHORTLAND, LL.D., published by his Widow and Children. London: Macmillan, 1890. Pp. 445. Size 9″ × 6½″ × 1½″. Weight under 2 lbs. 2 oz. Price 21*s.*

This work differs from other treatises on nautical surveying in the fact that the author has devoted much space to close investigation of the mathematical bases on which each step rests.

The theory of the instruments employed, with their errors, the astronomical observations, with minute directions for carrying them out, triangulation, plotting, projections, and tides, are all subjected to the same treatment, providing the scientific marine surveyor with the means of studying the *arcana* of his craft, which he has never had before, and which only a finished mathematician, like Admiral Shortland, could have written.

The chapter on tides is especially valuable, as it describes a method of calculating a tide table from observations of high and low water, which, though not so rigorously accurate in its results as the method of harmonic analysis, is more within the range of practical possibilities, and gives a closer determination than the seaman really requires.

Though the time at disposal seldom permits, and the necessities of navigation do not often require, the whole of the niceties inculcated by Admiral Shortland, it is a subject of congratulation that this work has at length been published, as, no matter what improvements time may produce in the means at the disposal of the marine surveyor the groundwork, as here presented, will for ever remain as a firm foundation on which to build.

Historical Records of the 53*rd* (*Shropshire*) *Regiment, now the* 1*st Battalion The King's* (*Shropshire*) *L.I., from the Formation of the Regiment in* 1755 *down to* 1889. Compiled and edited by Colonel W. ROGERSON, from the Orderly Room Records. London: Simpkin, Marshall, and Co.; Devonport: Swiss. Pp. 248. Size 9″ × 6″ × 1″. Weight under 1¼ lbs. Price 25*s.*

At the publication of each fresh "Historical Record" our wonder increases. Either the original recorder failed in his task, or the Officers who edit the records are too modest. Here is a regiment which has seen much and varied service in all four quarters of the globe; its colours carry no less than twenty-one distinctions, and yet the compilation of their deeds and regimental life is insufficient to cover more than 248 pages of by no means closely printed matter. Surely the orderly room records of a distinguished corps, like the Shropshire, must teem with detailed accounts of brave and soldierly deeds of Officers, non-commissioned officers, and men, which would be examples for the teaching of the young soldiers of the Army of to-day, whether Shropshires or not. This is the sort of literature which is asked for now by Officers desirous of training their men morally, as well as physically, and we cannot but regret that a corps like the old 53rd has given us out of its store such a meagre allowance of valuable information.

Nelson's Words and Deeds. Edited by W. CLARK RUSSELL. London: Sampson Low, 1890. Pp. 222. Size 7½″ × 5″ × ¾″. Weight under 12 oz. Price 3*s.* 6*d.*

This is a short collection of interesting extracts, mainly from the unofficial letters of Nelson, and illustrative of his character. It would be advantageous if in any future edition a few notes were added, giving a clue to the occasion on which each letter was written from which the extract is taken.

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